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CONTENTS

VOLUME 9 1996

Muelleria 9:1–4 (1996)

Obituary: Dr James Hamlyn Willis AM
28 January 1910–10 November 1995

Dr James H. Willis AM, photographed in June 1981. (Photograph provided by the Library, Royal Botanic Gardens, Melbourne.)

It is with great sadness but with sincere thankfulness for his long and fruitful life that we record the death of Dr James Hamlyn Willis AM on 10 November 1995, in his eighty-sixth year. His death followed a severe cerebral haemorrhage less than two days previously.

To all his friends and colleagues Dr Willis was simply and affectionately known as 'Jim'. An unassuming man of gentle and compassionate disposition, his friendliness and help enriched the lives of all he encountered. He was a man both liked and respected and we will miss him greatly.

Jim Willis was born in the Melbourne suburb of Oakleigh, Victoria, on 28 January 1910. His boyhood years were spent with his parents and older brother Rupert first at Yarram, in South Gippsland, Victoria, and then at Stanley in north-west Tasmania. When fourteeen years of age he was sent to Melbourne for secondary schooling at Melbourne High School, from where he matriculated at the end of 1927. Obeying the call of an open-air life, he obtained a three-year scholarship to the Victorian School of Forestry, Creswick, completing his course there in December 1930, and receiving the Diploma of the Victorian Forests Commission.

For the following seven years from 1931 to 1937, Jim served as a forest officer with the Commission, moving between varied forest districts as instructed. Based consecutively at Creswick, Belgrave, Cockatoo, Maryborough, Bealiba and Daylesford, he took every opportunity to acquaint himself with the flora and fauna around him. Forestry was never his true calling, his desire being to enter the field of professional botany. When he heard of forthcoming retirements from the National Herbarium of Victoria, Melbourne, he successfully negotiated an inter-departmental secondment, then transfer, out of the Forests Commission. Thus in October 1937 Jim Willis commenced his outstanding career of 34 years as a professional taxonomic botanist at the National Herbarium of Victoria, a career which only ended with his voluntary retirement on his sixty-second birthday on 28 January 1972.

While a forestry student, Jim had met Mavis Howie, a Creswick local and a bush-lover like himself. They married in October 1933. Soon after Jim commenced work in Melbourne the couple took up residence in the bayside suburb of Brighton, which became their permanent home. From here Jim cycled to and from the Herbarium each day, a practice which he maintained for many years until eventually train travel superceded his bike. While working, he attended the University of Melbourne part-time during 1938 and 1939 to qualify for the Bachelor of Science degree (with honours), conferred in April 1940.

Herbarium employment gave Jim increased contact with both amateur and professional botanists and increased opportunities to visit new areas. He corresponded widely with interstate and overseas botanists and revelled in field expeditions to different floristic regions. The Victorian Alps in 1938 and East Gippsland in the 1940s and 1950s provided notable new field experiences within Victoria and he was delighted with his inclusion in expeditions to Western Australia, first as a member of the Sir Russel Grimwade Expedition in 1947 and then to the Recherche Archipelago in 1950. He became the first editor of the Herbarium's research journal, *Muelleria*, editing the first three numbers, Vol.1 no.1 being distributed in 1956. As his knowledge, researches and publications grew, he received progressive promotions within the Herbarium.

During 1958-1959 Jim spent 14 months on secondment as Australian Botanical Liaison Officer at Kew Herbarium, England, making many botanical contacts and travelling both in the United Kingdom and in European countries during this term. On return from secondment he resumed duties at the National Herbarium and in May 1961 he was promoted to the position of Assistant Government Botanist. Despite increased administrative responsibilities his researches and field trips continued, including forays to New Guinea and New Zealand. For the last 15 months of his service he became Acting Director of the Royal Botanic Gardens and National Herbarium pending the appointment of a new Director. He neither wanted nor particularly enjoyed the greater managerial role that the position imposed, but the work had to be done and he applied himself diligently and successfully to the task.

From his boyhood years in Tasmania, through his early forestry years and his long herbarium career in taxonomic botany, Jim pursued his innate interest in natural history with unfailing enthusiasm. Rocks, minerals, shells and plants were all collected and studied; birds, insects and other faunal groups received his intelligent attention. Botanically he researched and published not only on flowering plants but on lower plant groups also, particularly mosses and fungi. He was a man of prodigious energy, with an enormous capacity for work, frequently continuing throughout his lunchtime and late into the night. His activities continued unabated after his retirement and even his declining health during the last two years did not defeat him. Only a few weeks before his death he had delivered the opening address to the national conference of the Society for Growing Australian Plants, held in Ballarat.

In his taxonomic role, Jim described 42 new plant species himself and a further 22 species with co-authors, besides describing several new plant varieties and publishing many new nomenclatural combinations. He was a prolific correspondent and avid reader, with a full realisation of the importance of history in taxonomy. His meticulously compiled files on botanists, collectors, explorers, collecting localities and handwritings are invaluable taxonomic and curatorial tools, and his publications include many on the history of botanical exploration and on the biographies of botanists. Annotations in Jim's exquisitely neat handwriting are prolific throughout the Herbarium collections and library and show how carefully he would cross-check information, correcting or expanding as required. Inevitably his botanical interests extended beyond taxonomy. He prepared floristic lists for local areas, published descriptive accounts of vegetation, and was an early voice for conservation. Exotic plants and horticulture also received his attention and his total revision of E.E. Lord's book *Shrubs and Trees for Australian Gardens* for its fifth edition (1982) is a notable contribution in this field.

In all, Jim has published approximately 883 books, scientific and popular papers, pamphlets, essays and reviews. His *A Handbook to Plants in Victoria*, Vol. 1 (1962; 2nd edn 1970) and Vol. 2 (1973), marked a milestone for Victorian botany, not only by replacing A.J. Ewart's outdated *Flora of Victoria* (1931) but also because of its originality. This was no slavish compilation from the writings of others but a work based largely on Jim's own meticulously gathered, first hand observations. The 'Handbook' is only now being replaced as a new, multi-authored, four-volume *Flora of Victoria* comes off press.

In the field, Jim's energy and enthusiasm knew no bounds. Time would be forgotten as he searched and collected and he has been known to descend the most rugged of mountains in the dark alone after having failed to notice how rapidly daylight was departing. He could not drive a car himself, but his many friends and colleagues were always delighted to have him accompany them on their bush expeditions for he was both a splendid companion and a fountain of information.

Jim Willis gave his time and knowledge and encouragement unstintingly to those who sought his help, extending courtesy and friendship to professional and amateur, adult or schoolchild, alike. He would identify piles of specimens for enquirers but no one was ever made to feel that they were intruding on his time. His popularity as a clear, fluent and erudite public speaker was enormous and he was always in demand for lectures to scientific and community groups. For these he had thousands of colour transparencies, almost all taken by himself, all neatly labelled and catalogued according to subject matter. Topics covered were as diverse as his many interests. He was an active member of some 16 botanically-oriented organizations, including the Field Naturalists Club of Victoria (continuous membership since 1932), Royal Society of Victoria, National Trust of Australia (Victoria), Australian Conservation Foundation, Victorian National Parks Association and the Society for Growing Australian Plants. Additionally he would often travel far afield throughout Victoria to speak to local groups or lead them on field excursions. He has given so much of his talent to so many that the flow-on effect of this alone has ensured his place as one of the great men of Australian botanical and natural history science.

Although Jim never had any desire for fame, status or prestige, honors naturally came his way over the years. His contributions were too great to remain unrecognised. Professional colleagues have named eight plant species with the epithets '*willisii*', '*willisiana*' and '*jamesiana*'in his honour. In 1960 he received the Australian Natural History Medallion 'for special study and for increasing knowledge and appreciation of natural history in Australia'. In 1973 he was awarded the Royal Society of Victoria's silver medal for research. In January 1974 the Faculty of Science, Monash University, appointed him an honorary Fellow and in August of the same year he received his Doctorate of Science from The University of Melbourne for published works. In May 1976 he became a Fellow of the Linnean Society of London (*Honoris causa*). The Friends of the Royal Botanic Gardens, Melbourne, appointed him an Honorary Life Member in November 1989 and in September 1990 he was the first Victorian to receive the Award of Excellence from the Australian Institute of Horticulture. The Australian Conservation Foundation conferred Honorary Life Membership upon him in November 1991 and in 1993 the Victorian Division of the National Trust of Australia awarded him its Certificate of Honour. Most recently, to the delight of his family and all associated with him, Jim was made a Member of the Order of Australia in June 1995.

Jim's marriage in 1933 has already been mentioned. He could not have chosen a more loving or supportive wife and Mavis has her own well-deserved place in our affections. As devout and committed Christian people, both have lived lives of service to others and been active in their local Uniting (formerly Methodist) Church in New Street, Brighton. Here Jim was a lay preacher and sometime choir member, with a fine bass-baritone solo voice. Together Jim and Mavis have shared their lives and activities, supported local communities, given solace and practical help to those in need, raised two sons and 3 daughters (Ruth, Ian, David, Helen and Dorothy), and delighted in their 15 grandchildren and 4 great-grandsons.

Jim Willis was a superb all-round naturalist and one of the greatest Australian botanists of this century. He was also a man of absolute personal integrity, a caring family and community man, and a splendid companion and friend. He inspired and led by example. The over-capacity attendance and the eulogies spoken at the thanksgiving service for his life are testimony to the high esteem and affection in which he was held.

For a greater appreciation of Jim's life and work refer to the biographical sketch and list of publications in *Muelleria* 3(2): 69-88 (1975). It is hoped that an updated list of publications will be placed in the 1997 issue. An account of Jim's contribution to mycology is detailed in the *Australasian Mycological Newsletter* No 15(1): 3–7 (March 1996) and an account of his contribution to the Field Naturalists Club of Victoria has appeared in the *Victorian Naturalist* 113: 44–46 (1996).

Helen I. Aston

Muelleria 9: 5–13 (1996)

A Taxonomic revision of *Aleurites* J.R. Forst. & G.Forst. (Euphorbiaceae) in Australia and New Guinea

Paul I. Forster

Queensland Herbarium, Department of Environment, Meiers Road, Indooroopilly, 4068, Queensland, Australia.

ABSTRACT

The genus *Aleurites* J.R.Forst. & G.Forst. is revised for Australia and New Guinea, and includes two species *Aleurites moluccana* (L.) Willd. and *A. rockinghamensis* (Baill.) P.I.Forst. *comb. et stat. nov.* Both species are illustrated and notes on distribution, habitat, typification and conservation status are provided. A lectotype is selected for the name *A. moluccana* var. *rockinghamensis* Baill.

Introduction

The genus *Aleurites* was described by J.R. & G. Forster (1776). It included the single species *A. triloba*, based on a collection that they had made at Tonga in the Pacific Ocean while naturalists on James Cook's third voyage of discovery. The same species had been previously described under *Jatropha* as *J. moluccana* L. (Linneaus 1753) and this earlier name was subsequently transferred to *Aleurites* by Willdenow (1805).

Aleurites has a wide distribution in Asia, Malesia, Melanesia and Australia, with one species *A. moluccana* widespread and common throughout the entire range (Airy Shaw 1980, 1981; Smith 1981; Wagner *et al.* 1990). The genus was included by Webster (1994) in Euphorbiaceae subfamily Crotonoideae, tribe Aleuritidcae Hurusawa, Subtribe Aleuritinae (Hurusawa) Webster, together with *Vernicia* Lour. and *Reutealis* Airy Shaw.

At times *Aleurites* has had up to six species included in it (e.g. Mueller 1866; Webster 1967; Wagner *et al.* 1990); however, several of these, including the Chinese Tung-Oil Tree (formerly *A. fordii* Hemsl.) are better placed in *Vernicia* (e.g. Radcliffe-Smith 1987). Authors of recent accounts of *Aleurites* have indicated that only a single species *A. moluccana* exists with two or three varieties (Airy Shaw 1981), although Radcliffe-Smith (1987) considered the genus to comprise two species. *Aleurites moluccana* has been considered a polymorphic species by several authors with *A. moluccana* var. *moluccana* being widespread throughout the species range; *A moluccana* var. *rockinghamensis* Baill. being endemic to Australia (Baillon 1866), *A. moluccana* var. *floccosa* Airy Shaw endemic to New Guinea (Airy Shaw 1966) and several varieties endemic to Hawaii (Sherff 1951; Stone 1967; Degener & Degener 1971). These Hawaiian varieties are no longer recognised (Wagner *et al.* 1990).

There is also the problem of *A. erratica* Deg., I. Deg. & Hummel. *Aleurites erratica* was named on the basis of drift seed collected at Canton Atoll in the Pacific by the Degeners who distinguished it from *A. moluccana* on surface patterning (Degener *et al.* 1978). The name *A. erratica* has been applied to drift seed on an atoll on the north-east Australian coast (Smith 1994), but not to any naturally occurring populations in Australia and New Guinea. Although *A. erratica* is probably a synonym of *A. moluccana*, some critical attention is required to determine why the different seed patterning occurs, before it is dismissed out of hand.

In the present paper I have restricted the geographical coverage to populations of *Aleurites* that occur naturally in Australia and New Guinea. Most of the range outside this area has only *A. moluccana s.s.* present, and there is little need to review the available material yet again.

Thus, this leaves the question of the two or three varieties of *A. moluccana* in Australia and New Guinea (Airy Shaw 1980, 1981). *Aleurites* was first recorded for Australia by Mueller (1865), who thought that the Australian species was *A. triloba*. Shortly after, Baillon (1866) described *A. moluccana* var. *rockinghamensis* from material collected by Dallachy in north Queensland, although only *A. moluccana* was recognised by Bentham (1873) and Bailey (1902). In New Guinea, the first record of *Aleurites* was for *A. moluccana* (Smith 1910), with *A. moluccanna* var. *floccosa* described from the Bulolo Valley by Airy Shaw (1966).

In his final contribution on the genus, Airy Shaw (1981) enumerated two varieties for Australia, *A. moluccana* var. *moluccana* and *A. moluccana* var. *rockinghamensis* and placed *A. moluccana* var. *floccosa* from New Guinea, with a question mark, in the synonymy of *A. moluccana* var. *rockinghamensis*. He distinguished the two varieties with:

'var. **moluccana** . . . Indumentum thin, evanescent; leaves relatively narrow, not or rarely cordate; ovary and fruit bilocular . . .

var. **rockinghamensis** . . . Indumentum evident, subfloccose; leaves broader, mostly cordate; ovary and fruit 3(-4)-locular.'

Aleurites moluccana s.s. and *A. moluccana* var. *rockinghamensis* are largely allopatric throughout their known range with the former growing in more xeromorphic rainforest/vineforest communities than the latter. There are several known examples of sympatry, namely at the base of Big Tableland (G. Sankowsky *pers. comm.* 1992) and just north of the Bloomfield River at Wujal Wujal (pers. obs. 1994). No intermediate individuals have been observed at these localities. In addition to the differences outlined by Airy Shaw (1981), there are also discontinuities in floral and seedling morphology. Given the distribution of the two taxa, the lack of intermediates and the many morphological discontinuities, *A. moluccana* var. *rockinghamensis* is elevated to species status in this paper.

Materials and methods

This revision is based on herbarium holdings at AD, BRI, CANB, CBG, DNA, MEL, NSW and QRS and field observations and collections by the author in Australia and New Guinea.

Floral descriptions were prepared from material preserved in spirit (FAA or 70% alcohol and glycerol) or reconstituted by boiling in water and detergent. Fruit and seed descriptions were prepared from material preserved in spirit or dried. Foliage and inflorescence descriptions were prepared from dried material. Indumentum cover is described using the terminology of Hewson (1988), except that 'scattered' is used instead of 'isolated'.

The 'Wet Tropics' is defined as the area of north-eastern Queensland that encompasses the 'hot, humid, vine forests' from near Cooktown in the north to Paluma in the south (Webb & Tracey 1981; Barlow & Hyland 1988). Rainforest terminology follows Webb (1978).

Taxonomy

Aleurites J.R.Forst. & G.Forst., *Char. Gen. Pl.* 111 (1776). TYPE: *Aleurites moluccana* (L.) Willd.

Derivation of name: from the Greek for 'wheaten flour', alluding to the mealy appearance of the lower leaf surface.

Trees, monoecious, evergreen, perennial; stems and foliage without obvious latex. *Indumentum* of simple or stellate, multicellular trichomes, not glandular, stinging hairs absent. *Stipules* entire, inconspicuous, deciduous. *Leaves* alternate, petiolate, palminerved, lobate, entire, with 2 glands at base of lamina. *Inflorescences* terminal, paniculate, solitary, uni- or bisexual with the flowers in bracteate clusters. *Bisexual*

inflorescences with a solitary female flower terminating each major axis, lateral cymules male. *Female flowers*: short pedicellate; calyx closed in bud, rupturing into 2 or 3 lobes; petals 5(6), free, imbricate, disc 5-lobed; ovary 2-4-locular, ovules uniloculate; styles 2 or 3, fused at base, bilobed. *Male flowers*: long pedicellate; calyx closed in bud, rupturing into 2 or 3 lobes; petals 5(6), free, imbricate, disk 5-lobed; stamens 4-verticillate, numerous, the outer ones free, the inner ones ± united and borne on a conical receptacle, anthers dorsifixed, introrse and bilobate, thecae oblong and longitudinally dehiscent; pistillodes absent. *Fruits* drupaceous, indehiscent; exocarp fleshy; endocarp woody, 1-4-locular. *Seeds* ovoid to globose; testa woody; albumen hard; ecarunculate; germination epigeal; cotyledons broad, flat.

A genus of two (or perhaps three) species in tropical Asia, Malesia, Melanesia and Australia. Two species in Australia and New Guinea.

KEY TO THE SPECIES OF *ALEURITES* IN AUSTRALIA AND NEW GUINEA

1 Indumentum silver; lower leaf surface glabrous or with scattered trichomes; flowers 5-8 mm long; stamens 18-26; styles 0.5-2 mm long; ovary and fruit 1-2(-3)-locular ..... **1. *Aleurites moluccana***

1: Indumentum ferruginous-silver; lower leaf surface with sparse to dense, generally velutinous trichomes; flowers 8-12 mm long; stamens 24-32; styles 2.8-3 mm long; ovary and fruit 3-4-locular ..... **2. *Aleurites rockinghamensis***

1. *Aleurites moluccana* (L.) Willd., *Sp. Pl.* 4: 590 (1805). *Jatropha moluccana* L., *Sp. Pl.* 1006 (1753). TYPE: Ceylon, *Hermann Herbarium* Vol. III, p. 27 (LECTOTYPE: *fide Radcliffe-Smith* (1987: 176): BM [photo at BRI]). *Aleurites triloba* Forst. & G.Forst. *Char. Gen. Pl.* 112, t. 56 (1776). TYPE: Tonga, *Forster 214.360* (HOLOTYPE: BM [photo at BRI]).

Illustrations: Christophel & Hyland (1993: 96, plate 34d); Radke *et al.* (1993: 16).

Large spreading tree to 30 m high; trunk straight and without fluting or buttressing. *Bark* smooth, grey, nondescript; blaze pink to red. *Young shoots* with dense, short, silver, stellate hairs. *Stipules* cylindric, c. 1 mm long, with dense short, silver, stellate hairs. *Petioles* 35-110 mm long, 1-1.5 mm diameter, with dense, short, silver stellate hairs. *Leaf laminas* entire or 3 or 5-lobed, ovate, ovate-lanceolate or ovate-trullate, 70-200 mm long, 40-130 mm wide, 3 or 5-veined from base and with 6-8 major lateral veins per side of midrib; upper surface dull green, glabrous or with scattered silver stellate hairs when young; lower surface pale green, glabrous or with scattered, silver, stellate hairs when young; apex acute to acuminate; base cuneate. *Inflorescence* conical, 30-100 mm long and wide; axis with dense, short, silver, stellate hairs. *Male flowers* 5-6 mm long, c. 5 mm diameter; pedicels filiform, 5.5-8 mm long, 0.3-0.5 mm diameter, with dense, short, silver, stellate hairs; buds ovoid, 2.5-3 mm long, 2-2.5 mm diameter; calyx 2 or rarely 3-parted, halves often unequal, lanceolate to ovate, 2.5-3 mm long, 1.5-2 mm wide, with dense, short, silver, stellate hairs; petals oblanceolate to spathulate, 4-6 mm long, 1.5-3 mm wide, white to cream, glabrous; stamens 18-26; filaments 0.8-1.5 mm long, with sparse simple hairs; anthers 0.6-0.8 mm long, 0.3-0.6 mm wide, glabrous or with scattered, simple hairs; disc lobes convulate. *Female flowers* 7-8 mm long, 8-10 mm diameter; pedicels stout, 2-3.5 mm long, 1-2 mm diameter, with dense, short, silver, stellate hairs; buds ellipsoid, 4-5 mm long, c. 2 mm diameter; calyx with 2 or 3 unequal lobes, each lobe 3-3.5 mm long, 1.5-2 mm wide, lanceolate to ovate, with dense, short, silver, stellate hairs; petals oblanceolate to spathulate, 6-8 mm long, 1.8-2 mm wide, white to cream, internally glabrous, externally glabrous or with a few simple hairs in a longitudinal band in the middle; ovaries 1-2-celled, subglobose, 2-3 mm long, 2-4 mm diameter, with dense, yellow, stellate hairs; styles 0.5-2 mm long, ± glabrous or with a few simple hairs; disc glands small and rounded. *Fruit* ovoid-subglobose, 40-45 mm long, 40-60 mm diameter, with scattered silver, stellate hairs. *Seed* broadly ovoid, 23-32 mm long, 20-32 mm diameter, greyish. *Seedlings* at third leaf stage (voucher: *Hyland RFK25545*): cotyledons broadly ovate-obovate, 18-22 mm long, 18-20 mm wide, strongly 5-veined from base, glands

not obvious; first seedling leaf trilobed with the median lobe long-acuminate; later leaves becoming 5-lobed. (Fig. 1)

DISTRIBUTION AND CONSERVATION STATUS

Aleurites moluccana is widespread in Malesia and Melanesia, and often planted in other tropical areas. In Australia *A. moluccana* is restricted to north Queensland where it is common on Cape York Peninsula and in the northern part of the 'Wet Tropics' region reaching a southern limit on the Windsor Tableland. There is also a southerly disjunct population at Daydream Island. In New Guinea, *A. moluccana* is found in lowland areas, and is widespread on the island.

Aleurites moluccana is common throughout its range.

HABITAT AND ECOLOGY

Plants grow in semi-deciduous to evergreen notophyll or mesophyll vineforest, on a variety of substrates, but often on alluvium or near the sea. Young plants are common as pioneers in disturbed gaps or margins of the vineforest. The seed is a distinctive component of the drift flora of the Pacific (cf. Degener *et al.* 1978; Smith 1994).

The plant (and also *A. rockinghamensis*) is commonly known as 'Candle-Nut' and it is possible to use the fruits as a source of light by stringing them on wire and setting them alight.

NOTES

Aleurites moluccana may be distinguished from *A. rockinghamensis* on at least five morphological discontinuities (as given in the species key), as well as the seedling characters outlined in the species descriptions. It should be noted that the dimensions of seedling leaves and cotyledons may change with age and subsequent development; however, the basic differences of shape and venation remain the same.

REPRESENTATIVE SPECIMENS

IRIAN JAYA: Warnapi, 15 km N of Ransiki, Sep. 1948, *Kostermans 425* (BRI); Sorong, behind Kp. Baroe, July 1948, *Pleyte 454* (BRI); Kebar Valley, Oct. 1958, *Schram BW7709* (CANB).

PAPUA NEW GUINEA: Madang Province: near Gurumbu Village, SW foothills of Finisterre Mtns, Aug. 1955, *Hoogland 5140* (BRI, CANB). New Britain Province: NE ridge of Mt Penak, N of S.D.A. Mission, Talasea, May 1968, *Frodin NGF26729* (BRI). Western Province: Lower Fly river, east bank opp. Sturt Island, Oct. 1936, *Brass 7997* (BRI, CANB). Northern Province: Kokoda Trail, July 1964, *Millar NGF23573* (BRI). Central Province: Kaota, Rona, Laloki River, Mar. 1933, *Brass 3644* (BRI). Milne Bay Province: Fife Bay, Sep. 1930, *Turner* [AQ201270] (BRI).

QUEENSLAND: Cook District: Eliott Falls, Jardine River, Oct. 1989, *O'Reilly 560* (BRI); Claudie River, Oct. 1972, *Dockrill 533* (BRI, QRS); Chester River Scrub, eastern fall of Mellwraith Range, June 1992, *Forster 10439 et al.* (BRI, QRS); Near T.R. 9, Lankelly to Pandanus Creek, Sep. 1971, *Hyland 5406* (BRI, QRS); Rocky River, Sep. 1971, *Hyland 5513* (BRI, QRS); Rocky River Scrub, Silver Plains, July 1993, *Forster 13622 et al.* (BRI); T.R. 176, Shipton L.A.. Aug. 1982, *Hyland 11923* (QRS); S.F.R. 144 Windsor Tableland, Oct. 1971, *Hyland 5577* (BRI, QRS); S.F.R. 144, Whypalla, Chowchilla L.A., Dec. 1987, *Hyland 13474* (QRS). North Kennedy District: Daydream Island, Whitsunday Region, Apr. 1990, *Batianoff 900431* (BRI).

2. *Aleurites rockinghamensis* (Baill.) P.I.Forst. *comb. et stat. nov.*

Aleurites moluccana var. *rockinghamensis* Baill., *Adansonia* 6: 297 (1866), basionym. TYPE: Queensland, Cook District: Rockingham's Bay [*Dallachy*]. LECTOTYPE: (**here designated**): MEL232486. LECTOPARATYPES: MEL232495, 232496, 232497, 232498. *Aleurites moluccana* var. *floccosa* Airy Shaw, *Kew Bull.* 20: 26 (1966). TYPE: Papua New Guinea, Morobe Province: Wau, 28 June 1962, *J.J. Havel NGF9169* (HOLOTYPE: K, *n.v.* ISOTYPES: BRI, QRS).

Illustration: Christophel & Hyland (1993: 97, plate 35a).

Large spreading tree to 30 m high; trunk straight and without fluting or buttressing. *Bark* smooth, grey, nondescript; blaze brown speckled to cream. *Young shoots* with

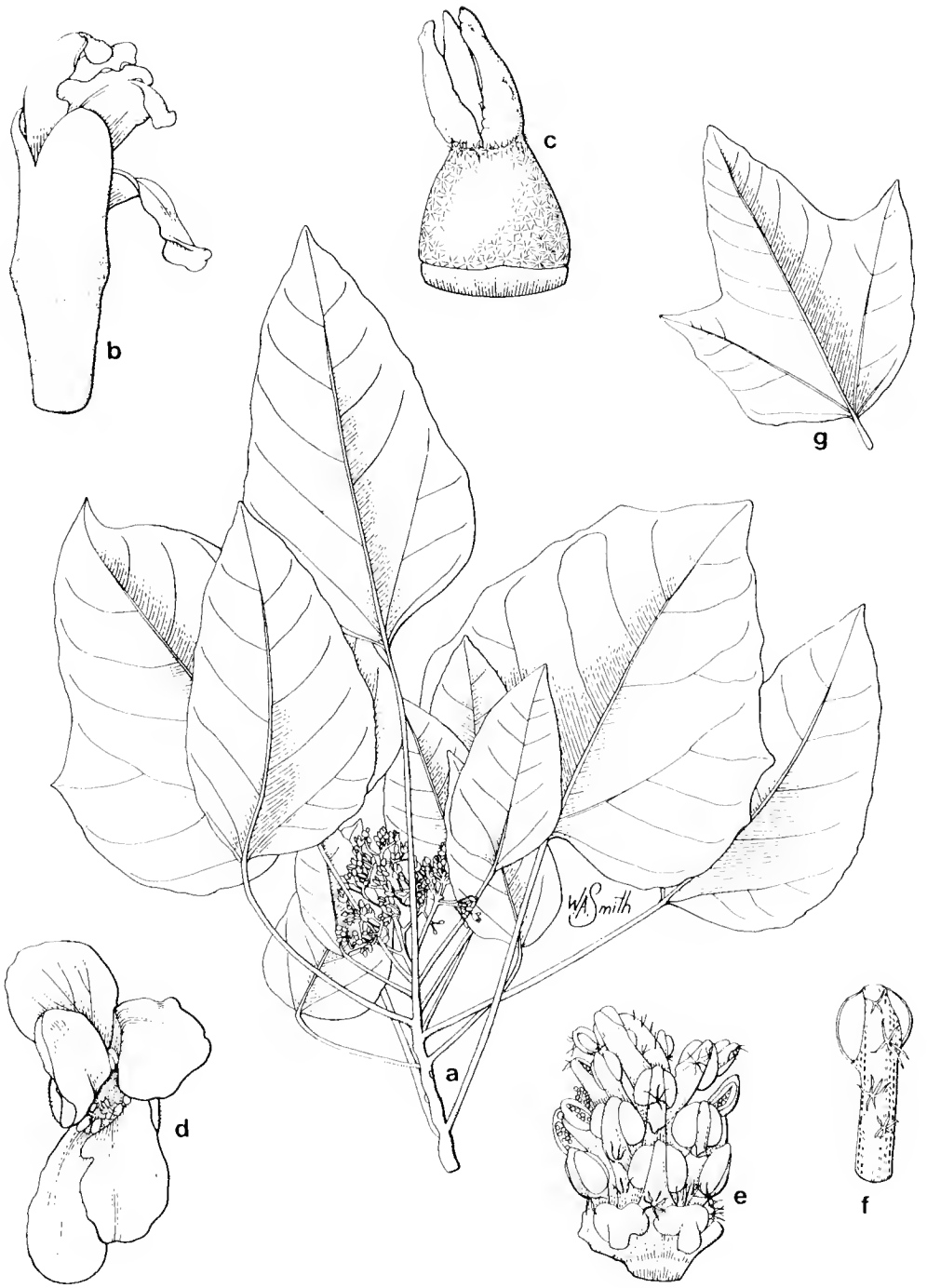

Fig. 1. *Aleurites moluccana*. a - flowering branch tip x0.4. b - gynostegium x10. c - lateral view of female flower x5. d - face view of male flower x5. e - lateral view of staminal mass x10. f - stamen showing stellate hairs x15. g - juvenile leaf showing lobing x0.4. a from *G.N.Batianoff 900431* (BRI); b, c from *B.Hyland 7809* (QRS); d-f from *B.Hyland RFK25167* (QRS); g from *M.O'Reilly 560* (BRI). Del. W. Smith.

dense, short, ferruginous-silver, stellate hairs. *Stipules* cylindric, c. 1 mm long, with dense short, ferruginous-silver, stellate hairs. *Petioles* 30-210 mm long, 3-6 mm diameter, with dense, short, ferruginous-silver, stellate hairs. Leaf laminas entire or 3-lobed, ovate, ovate-lanceolate or ovate-trullate, 110-400 mm long, 70-300 mm wide, 3 or 5-veined from base and with 6-8 major lateral veins per side of midrib; upper surface glossy green, with dense, short, ferruginous-silver, stellate hairs, becoming restricted to the veins with age; lower surface pale green, with sparse to dense, ferruginous-silver, stellate hairs when young, often becoming restricted to the veins with age but often remaining velutinous; apex acute to acuminate; base cuneate. Inflorescence conical, 10-300 mm long and wide; axis with dense, short, ferruginous-silver, stellate hairs. *Male flowers* 10-12 mm long, 10-12 mm diameter; pedicels filiform, 5-15 mm long, c. 1 mm diameter, with dense, short, ferruginous-silver, stellate hairs; buds ovoid, 3.5-4.5 mm long, 3.5-4 mm diameter; calyx 2 or rarely 3-parted, halves often unequal, lanceolate to ovate, 3-5.8 mm long, 3-4 mm wide, with dense, short, ferruginous-silver, stellate hairs; petals oblanceolate to spathulate, 5.5-10 mm long, 2-4 mm wide, white to cream, externally glabrous, internally with longitudinal strip of dense, simple hairs; stamens 24-32; filaments 0.8-1 mm long, with scattered simple hairs; anthers 0.5-0.9 mm long, 0.3-0.7 mm wide, with scattered, simple hairs; disc lobes convulate. *Female flowers* 8-10 mm long, 10-12 mm diameter; pedicels stout, 2-3 mm long, 1-2 mm diameter, with dense, short, ferruginous-silver, stellate hairs; buds ellipsoid, 4.5-6 mm long, 3-3.5 mm diameter; calyx with 2 or 3 unequal lobes, each lobe 4-7 mm long, 3-4.5 mm wide, lanceolate to ovate, with dense, short, ferruginous-silver, stellate hairs; petals oblanceolate to spathulate, 9-12 mm long, 3-4 mm wide, white to cream, internally glabrous, externally with a longitudinal band of dense, simple hairs in the middle; ovaries 3-4-celled, subglobose, c. 2 mm long and 2.5 mm diameter, with dense, yellow, simple or rarely stellate hairs; styles 2.8-3 mm long, with sparse, simple hairs; disc glands small and rounded. *Fruit* ovoid-subglobose, 50-65 mm long, 70-80 mm diameter, with sparse ferruginous-silver, stellate hairs. *Seed* globose, 20-25 mm long, 20-25 mm diameter, dark brown. *Seedlings* at third leaf stage (voucher: *Irvine 477* (QRS)): cotyledons broadly ovate-obovate, 95-100 mm long, 67-70 mm wide, weakly 5-veined from base, basal glands obvious; first seedling leaf trilobed with the median lobe acute; later leaves becoming entire. (Fig. 2)

DISTRIBUTION AND CONSERVATION STATUS

Aleurites rockinghamensis occurs in Australia and Papua New Guinea. In Australia it is largely restricted to the 'Wet Tropics' region of north-east Queensland, apart from a disjunct southerly occurrence near Ingham. In Papua New Guinea it has been recorded from lower montane parts of Morobe and Central Provinces.

Aleurites rockinghamensis is widespread and common in its known range.

HABITAT AND ECOLOGY

Plants grow in evergreen notophyll to mesophyll vineforests on a variety of substrates usually of volcanic origin. The species is a widespread pioneer and seedlings are common in gaps and margins of the forest.

NOTES

There are six sheets present in MEL that probably represent type material of the name *A. moluccana* var. *rockinghamensis*. None of them has a collector listed, although the 'Rockingham('s) Bay' labels are typical of those accompanying specimens collected by Dallachy and it seems reasonable to assume that he was indeed the collector. As lectotype I have selected one of the flowering portions that is also accompanied by nine lines of latin text. Some of the lectoparatypes are fertile, but most are leaves only. Specimens of *Aleurites* are difficult to fit onto a standard herbarium sheet and it is probable that the original collection has been split up in the mounting process.

Airy Shaw (1981) tentatively referred *A. moluccana* var. *floccosa* Airy Shaw to synonymy under *A. moluccana* var. *rockinghamensis*. The Papua New Guinean

specimens identified as *A. moluccana* var. *floccosa*, including the type, when compared with Australian material of *A. rockinghamensis*, often have male flowers with generally longer pedicels, and more noticeably velutinous lower surfaces of the leaves. The leaf indumentum cover is not consistent on all specimens and as there are no other differences, this later variety is reduced to synonymy.

REPRESENTATIVE SPECIMENS

PAPUA NEW GUINEA: Morobe Province: Crooked Creek, Bulolo, June 1962, *Havel & Henry NGF9163* (BRI); Watut Divide, Bulolo, Oct. 1969, *Streimann NGF44233* (CANB); Upper Watut, Feb. 1971, *Streimann & Kairo NGF44575* (BRI, CANB); Kauli Creek, Wau, Mar. 1962, *Millar NGF14503* (BRI, CANB); Edie Creek road, above Wau, May 1963, *van Royen NGF16311* (BRI, CANB); Sopa, June 1962, *Hartley 10342* (BRI, CANB); Boana, Apr. 1938, *Clemens 8119* (CANB). Central Province: On ridge below Boridi Village, Oct. 1973, *Foreman & Vinas LAE60238* (BRI).

QUEENSLAND: Cook District: c. 6 miles [10 km] NW of Daintree on bank of Daintree River, Nov. 1967, *Boyland 516 & Gillieatt* (BRI); Porn. 188 Alexandra, Hutchinson Creek, *Hyland 6726* (BRI, CANB, QRS); Rex Range, Little Mossman L.A., S.F. 141, Jan. 1993, *Forster 13073 & Bean* (BRI, L, MEL, QRS); Kuranda Range road, Mar. 1987, *Godwin C3034* (BRI); Mowbray River, Jan. 1932, *Brass 1991* (BRI); S.F.R. 933, Feb. 1975, *Hyland 8014* (BRI, CANB, QRS); S.F. 185 Danbulla, 1.5 km SW of Hoop Pine Triangle, Jan. 1993, *Forster 13080 & Bean* (BRI, MEL, QRS); S.F.R. 185, Nursery L.A., Dec. 1971, *Hyland 5737* (BRI, QRS); S.F.R. 194, on the Dividing Range near Oaky Creek, Jan. 1972, *Hyland 5749* (BRI, QRS); Tolga Scrub, Mar. 1973, *Irvine 477* (BRI, QRS); Near Barron River on Atherton to Yungaburra road, Mar. 1971, *Stocker 613* (BRI, QRS); Lake Eacham, Atherton Tableland, Aug. 1929, *Kajewski 1180* (BRI). North Kennedy District: S.F. 268, June 1994, *Forster 15640* (BRI, K, L, MEL, NSW, QRS).

Acknowledgements

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Fig. 2. *Aleurites rockinghamensis*. a - flowering branch tip x0.5. b - lateral view of female flower x4. c - face view of female flower x4. d - lateral view of gynostegium x8. e - face view of male flower x4. f - lateral view of staminal mass x8. g - stamen showing simple hairs x16. h - lateral view of fruit x0.4.i - cross-section of fruit showing 4 seeds x0.4. a-d from *P.I.Forster 13073 & A.R.Bean* (BRI); e-h from *P.I.Forster 13080 & A.R.Bean* (BRI); i from *W.Birch 55* (BRI). Del. W. Smith.

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Notes on *Hovea* R.Br. (Fabaceae): 6

J.H. Ross

National Herbarium of Victoria, Royal Botanic Gardens, Birdwood Avenue, South Yarra, 3141, Victoria, Australia.

ABSTRACT

Accounts of *Hovea linearis* (Sm.) R.Br., *H. longifolia* R.Br. and *H. acutifolia* A.Cunn. ex G.Don are provided. *Hovea linearis*, *H. heterophylla* A.Cunn. ex Hook.f., *H. heterophylla* forma *decipiens* Domin, *H. longifolia* and *H. acutifolia* are lectotypified.

Introduction

While continuing studies of the eastern Australian *Hovea* species, it became apparent that the description of *H. linearis* was based on discordant elements. This opportunity is taken to lectotypify the species in a manner that preserves the traditional and current usage of the name and to provide an account of the species. Accounts are also provided of *H. longifolia* and *H. acutifolia* and a lectotype is selected for each. Bentham, *Fl. Austral.* 2: 172 (1864), adopted a very broad concept of *H. longifolia*, as a result of which the name has been widely used for plants from South Australia, Queensland, New South Wales, Victoria and Tasmania. However, the species has a fairly restricted distribution in New South Wales. Attention is drawn to the range of morphological variation encountered within *H. acutifolia* and to difficulties experienced in naming some specimens with certainty.

Taxonomy

1. *Hovea linearis* (Sm.) R.Br. in W.T.Aiton, *Hortus Kew.* edn 2, 4: 275 (1812); Edwards, *Bot. Reg.* 6: t.463 (1820); DC., Prodr. 2: 115 (1825); Lodd., *Bot. Cab.* 13: t.1222 (1827); Paxton, *Bot. Mag.* 12: 75 (1846); Benth., *Fl. Austral.* 2: 172 (1864); Stanley & E. Ross, *Fl. South-eastern Queensland* 1: 270 (1983); Thompson & Lee in Lee & Thompson, *Fl. New South Wales* 101(2): 135 (1984). *Poiretia linearis* Sm., *Trans. Linn. Soc. London* 9: 304 (1808) *comb. illegit.*. *Phusicarpos linearis* (Sm.) Poir. in Lamarck & Poiret, *Encycl, méth. Bot.*, suppl. 4: 400 (1816). TYPE: New South Wales, Port Jackson, 1791, *J. White s.n.* LECTOTYPE (**here selected**) : LINN (sheet 1190.1 *pro parte.*) *Hovea heterophylla* A.Cunn. ex Hook.f., *Fl. Tasmaniae* 1: 93 (1856), t.15 (1855); Benth., *Fl. Austral.* 2: 172 (1864); Domin, Biblioth. Bot. 22: (89^2): 728 (1925); J.M. Black, *Fl. S. Australia* edn 2: 447 (1948); Burbidge & Gray, *Fl. Austral. Cap. Territ.* 218 (1970): J.H. Willis, *Handb. Pl. Victoria* 2: 281 (1973); W.M. Curtis, *Student's Fl. Tasmania* edn 2, 1: 148 (1975). TYPE: Tasmania, 1833, *R. Gunn 139*. LECTOPTYPE (**here selected**): K. *Hovea heterophylla* forma *decipiens* Domin, *Biblioth. Bot.* 22 (89^2): 175 (1925). TYPE: prope Brisbane River, Queensland, *A. Dietrich s.n.* LECTOTYPE (**here selected**) : HBG; ISOLECTOTYPES: BR1 345555, HBG (3 sheets), NSW 166774, PR 527083, 527084, PRC.

Subshrub to 1 m high, stems usually several, slender, procumbent, straggling or erect, sparingly to densely clothed with appressed to slightly spreading antrorse hairs. *Leaves* usually dimorphic, lamina of lower leaves usually ovate or elliptic, rarely rotund, (0.3-)1-5 cm long, (0.2-)0.5-1.3(-1.6) cm wide, lamina of upper leaves linear, linear-oblong or narrow ovate-oblong, 1.4-11 cm long, 0.3-0.7(-1) cm wide, the lamina

arched up slightly on either side of the midrib and the margins slightly recurved, upper surface glabrous and usually minutely bullate, lower surface sparingly to densely clothed with more or less appressed hairs; petiole 1-2 mm long, pubescent like the stem. *Stipules* subulate, 0.8-1.8 mm long, reflexed apically, persisting for some time and often glabrescent. *Inflorescence* axillary, sessile or on peduncles up to 1mm long, rarely auxotelic with growth extending apically, mostly 2- or 3-flowered. *Flowers* pedicellate, the pedicels up to 3 mm long, densely clothed with appressed to slightly spreading hairs; bracteoles narrow-ovate or oblong, 1-1.75 mm long, much shorter than the calyx-tube, tips often recurved, densely pubescent like the pedicel and bract; bract inserted 0.8-1.5 mm below the bracteoles, 0.8-1.75 mm long. *Calyx* densely clothed externally with predominantly long appressed or slightly spreading antrorse hairs: 2 upper lobes 4.8-5.8 mm long including the tube 1.8-3 mm long, 3 lower lobes 1.8-3 mm long, acute apically. *Standard* 7-9 mm long, 7.4-10 mm wide, pale mauve (rarely white); wings 6.4-8.5 mm long, 2.4-3.7 mm wide; keel petals 4.5-5.4 mm long, 2.2-2.7 mm wide. *Stamen-filaments* 3-5.5 mm long. *Ovary* sessile, 1.3-1.8 mm long, 2-ovulate, usually pubescent basally, apically and along the sutures but sometimes pubescent throughout. *Pods* sessile, obliquely globular, ovoid or ellipsoid or sometimes transversely elliptic, 0.75-1.2 cm long, 0.7-1.05 cm wide, 0.55-0.65 cm thick, external surface of valves with appressed usually ferruginous hairs throughout, on the sutures only, or sometimes glabrous, internal surface glabrous or with few scattered weak hairs. *Seeds* elliptic, plump, 3.4-4.5 mm long, 2.2-3.4 mm wide, 2.4-3.4 mm thick, black, hilum linear, the aril extending for less than 1/2 to 2/3 the length of the seed. (Fig. 1)

DISTRIBUTION AND ECOLOGY

The most widely distributed species in the genus extending from southern Queensland southwards to Tasmania and westwards through Victoria into south-eastern South Australia (Fig. 2). Occurs usually in open forest or woodland or in heathland where it favours sandstone, granite and limestone formations, shallow stony soils and sandy soils.

TYPIFICATION

It is clear from the protologue that when J.E. Smith described *Poiretia linearis* he had available specimens sent from New South Wales and material from a plant which flowered in Hibbert's garden in Clapham in 1798. In response to a request, Mr N.S. Lander photographed the type material of *P. linearis* housed in LINN (sheet 1190.1). The photographs confirmed that two different collections are present on this sheet: five twigs numbered 1 collected by White at Port Jackson in 1791 and one twig numbered 2 from Hibbert's garden at Clapham in 1798. The photographs suggested that, although superficially similar, the two collections mounted on the sheet of 1190.1 represented discordant elements. This was confirmed subsequently by Mr Lander who matched specimens sent on loan from MEL against the type material at LINN.

The material collected by White consists of flowering and fruiting specimens whereas the twig from Hibbert's garden is in young bud. It is clear from the protologue that the description of *P. linearis* was based largely, if perhaps not entirely, on the material collected by White. All of the information on pods, and it should be remembered that Smith erected the genus *Poiretia* principally upon the nature of the pod, and seeds must have come from White's specimens and, as the flowers on the Hibbert specimen are in bud, it is likely that the description of the flowers was taken from the White specimens too. The description of the stipules is also from the White material as the stipules are not evident on the Hibbert specimen. The description of the leaves and stem could have come from either the White or the Hibbert material.

The material collected by White is selected here as the lectotype of *P. linearis*, a choice which preserves the traditional and current usage of the name. The specimen from Hibbert's garden is a twig of *H. longifolia* which is interesting as it reveals that this species was in cultivation in England at least seven years earlier than it was thought to have been introduced by R. Brown.

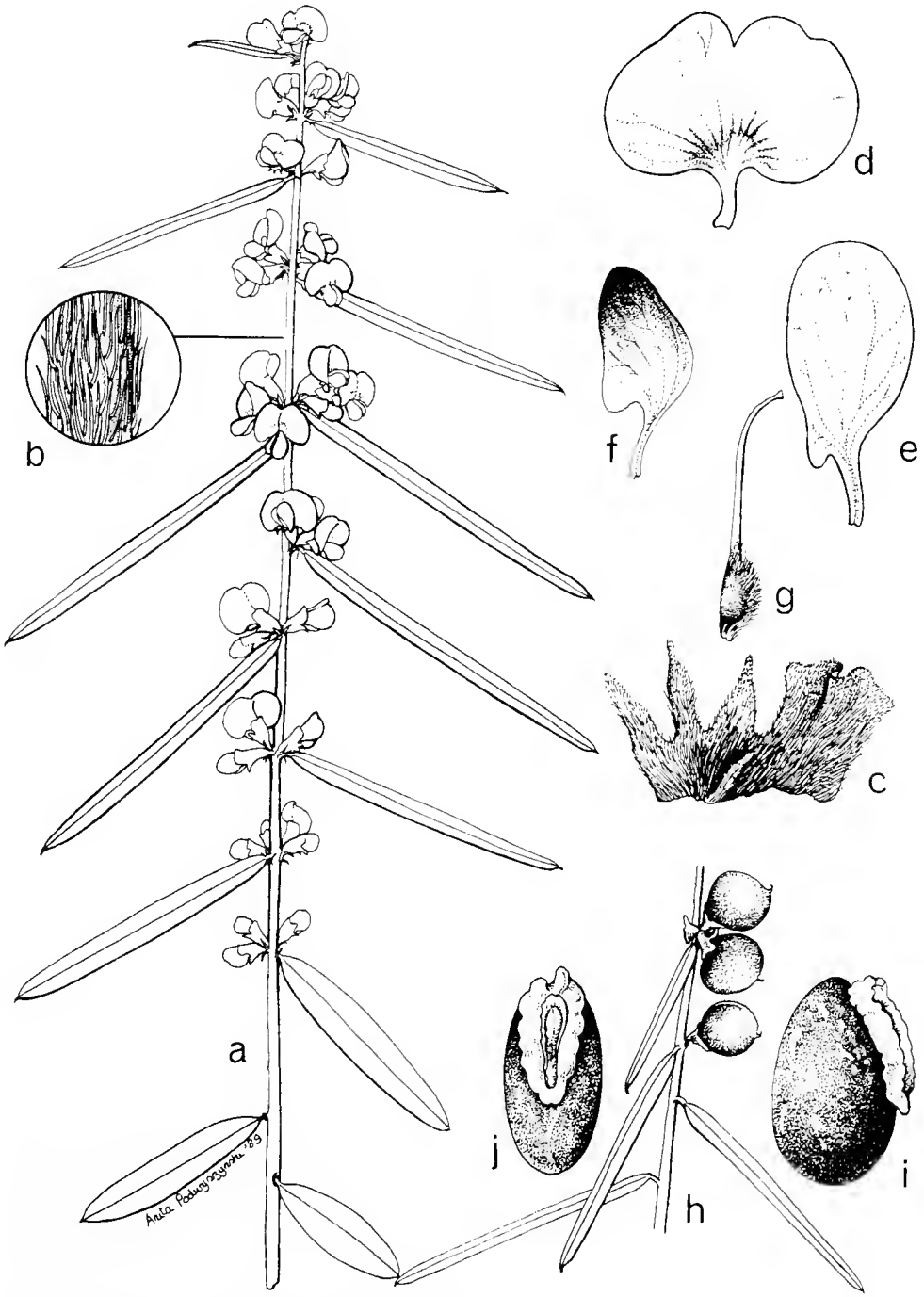

Fig. 1. *Hovea linearis*. a - flowering twig, x1. b - section of young stem showing the appressed antrorse hairs, x12. e - ealyx open out (upper lobes on right), x4. d - standard, x4. e - wing petal, x6. f - keel petal, x6. g - gynoecium, x6. h - fruiting twig, x1. i - seed, side view, x5. j - seed, hilar view x5. a and b from *Muir 4835* (MEL), e-g from *Muir 801* (MEL), h-j from *Muir 2011* (MEL).

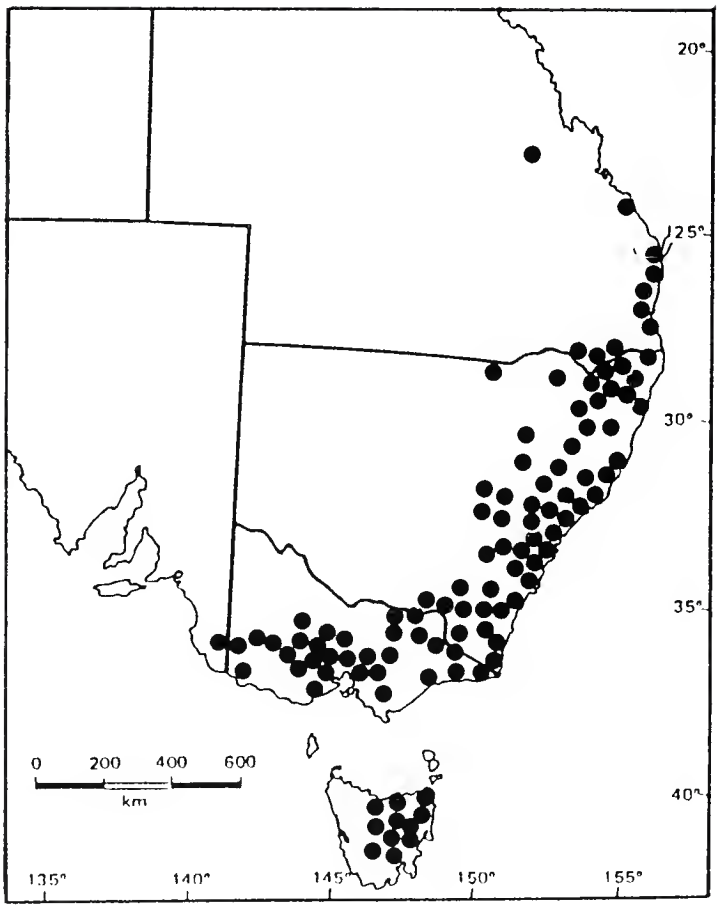

Fig. 2. Distribution of *Hovea linearis*.

Hooker (1856) adopted Cunningham's manuscript name and based his description of *H. heterophylla*, at least in part, on Tasmanian material collected by Gunn numbered 139 although he also cited in the protologue material from Tasmania collected by 'Lawrenee, Gunn, etc.' and noted that the species occurred in New South Wales and in south-east Australia. The numbers accompanying Gunn's specimens are not collecting numbers but species numbers as it was his custom to give the same number to collections of what he took to be one taxonomic entity even if the specimens were collected on different dates or from different localities (Burns & Skemp, 1961; Haegi, 1982; Buchanan, 1990).

In Herbarium Hookerianum at K there are three sheets of material associated with Gunn. One sheet of flowering and fruiting material is labelled 'V.D.L. 1833 Gunn 139' in two different hands, neither of them Gunn's. A second sheet bears a label in the top right hand corner in Gunn's hand which reads '139/1842 Hobart 15/9/40' with 'R. Gunn Esq.' in another hand. However, the specimen immediately to the left of this label has written on the sheet next to it and beneath Gunn's label 'V.D.L. Scott' indicating that it was collected by Scott. The major portion of this sheet is taken up with material collected by Lawrenee at Forest Formosa. It is not clear, therefore, to which specimen the Gunn label applies or whether in fact any of the material was actually collected by Gunn. A third sheet bears two fruiting and three flowering specimens and two labels, neither bearing a number, which read 'Stringy bark hill Hobartown Nov. 1840' and 'Grass tree hill Aug. 29 1840 Prostrate'. Written on this sheet below the label near the top left hand corner is 'R. Gunn Esq. V.D.Land'. Attached to this sheet are pencil drawings of details of the flowers and fruits. A fourth sheet at K, not stamped as having

been part of Herbarium Hookerianum, contains three different collections, namely, a specimen collected by R. Gunn in Tasmania and numbered 139, Milligan 522 from Tasmania, and A. Cunningham 269 collected in Aug. 1817 from Macquarie River, New South Wales. As Hooker appears to have attached special significance to the material labelled Gunn 139, the sheet in Herbarium Hookerianum clearly labelled 139 collected by Gunn in 1833 is selected here from among the syntypes as the lectotype of *H. heterophylla*.

Several collections housed in other herbaria labelled Gunn 139/1842 or 139, many in Gunn's hand, have been examined, the details of which are as follows:

- Hobarton, 12/9/1839, Gunn 139/1842 (BM)
- Hobart, 15/9/1840. Gunn 139/1842 (BM, MEL 106351 ex Herb. Sonder). BRI 242484 and NSW 166758 each consist of material distributed from BM and bear a label which reads 'Hobarton, 12/9/1839 and Hobart, 15/9/1840'. It is not clear whether or not each of these sheets contains a mixture of the two collections in BM numbered 139/1842 but collected on different dates.
- Degraves, Hobart, 14/12/1840, Gunn 139/1842 (NSW 166753)
- Penquite, 19/9/1841, Gunn 139/1842 (NSW 166757)
- Penquite, 18/9/1842, Gunn 139/1842 (NSW 166754)
- Penquite, 16/12/1844, Gunn 139 (HO 10724, NSW 166756)
- no data, Gunn 139 (CGE, NSW 166755, W)
- no data, Gunn s.n.(CGE ex Herb. Hook., E, W ex Herb. Hook. (3 sheets))
- Hobart, Gunn 139/1842 (CGE)

With the possible exception of the material in BM, that which was subsequently distributed from the BM to BRI and NSW, and sheets in CGE and W from Herbarium Hookerianum but bearing no data, none of the other collections would have been seen by Hooker. It would seem reasonable to regard these Gunn specimens mentioned in the previous sentence and housed in BM, BRI, CGE, and NSW (166758) as possible syntypes of *H. heterophylla*. However, in view of the uncertainty surrounding Gunn's collections, none of the remaining specimens is considered to represent type material.

Domin based his description of *H. heterophylla* forma *decipiens* on the following specimens from Queensland: 'Brisbane River, A. Dietrich s.n. (mehere exemplare); sandstone hills towards Brisbane, Leichhardt; Stradbroke Island, Fraser 1829'. Several specimens collected by Dietrich from near Brisbane are in HBG and specimens distributed from HBG have been located in BM, BRI, NSW, PR, PRC and W. Some of the specimens bear collecting numbers, for example *Dietrich 36*, *46*, and *77* (HBG), *Dietrich 45* (BM), *Dietrich 37* (W), which presumably indicates that they are not to be regarded as syntypes as the Dietrich specimens to which Domin referred in the protologue were unnumbered. The following unnumbered specimens have been seen: Dietrich s.n. (BRI 345555, HBG (4 sheets), NSW 166774, PR 527083, 527084, PRC, W). None of the unnumbered sheets is annotated by Domin but the two sheets in PR bear a label on which is typed 'Hovea heterophylla A. Cunn. var. decipiens Domin'. Although the unnumbered Dietrich specimens are relatively uniform in appearance (all of the specimens are in flower except for one twig on one of the sheets in HBG which bears pods), there is no means of knowing whether or not they were collected at the same time and place and they are here treated as syntypes. The Leichhardt and Fraser specimens from 'towards Brisbane' and 'Stradbroke Island' respectively are in K. It is probable that Domin examined the Dietrich material that he cited in the protologue while visiting HBG. It is known that Domin requested and received some Dietrich duplicates from HBG (Sumner, 1988), but which actual specimens were received is not known. There is no evidence that Domin had in his possession at PR the two sheets of unnumbered Dietrich material collected from near the Brisbane River prior to the publication of his forma *decipiens*. The plain white label on each sheet, which has printed at the foot on the right hand side 'Rev. Dr. K. Domin' and serves in effect as a determinavit label, has typed on it 'Hovea heterophylla A. CUNN. var decipiens DOMIN'. Each label bears in the bottom left hand corner a stamped 'akc. no. 23/1960' which suggests that the specimens were received or processed in 1960 rather than prior

to 1925. As a consequence, neither sheet of the PR material is selected as the lectotype. One of the sheets of unnumbered Dietrich material in HBG collected from near the Brisbane River is selected here from among the syntypes as the lectotype of *H. heterophylla* forma *decipiens* Domin.

NOTES

Given the difficulty often experienced in identifying *Hovea* species in eastern Australia, it seems somewhat incongruous that the most widely distributed species is also one of the easiest to recognize. *H. linearis* is characterised by the long antrorse usually appressed to slightly spreading hairs on the branchlets and the lower surface of the leaves and by the glabrous and usually minutely bullate upper leaf surfaces. The low stature of the plants and the usually reflexed stipules, which often persist for some time, further help to distinguish the species. The leaves in *H. linearis* are not always dimorphic, and this, coupled with the occurrence of dimorphic leaves in some of the other species, renders this character less useful in differentiating *H. linearis* than indicated by some other workers. An unnamed taxon from the North Kennedy District in northern Queensland with dimorphic leaves and low stature (*Conn & Clarkson 1146*, *Entwisle 2429*, *Foreman 1771*) is superficially similar to *H. linearis* but has a quite different indumentum.

Apart from the variation in leaf size and shape encountered on individual plants because of the usual presence of dimorphic leaves, a considerable amount of variation in leaf shape is present within the species. The extremes of variation encountered are exemplified by material of typical *H. linearis* from the central coastal areas of New South Wales on the one hand and material of typical *H. heterophylla* from Tasmania on the other. In the former the leaves are nearly all linear-oblong and very much longer than wide (usually at least 12 times longer than wide),the stems are often erect, and the pod valves are usually glabrous externally or the hairs are confined to the sutures and base. In typical *H. heterophylla* the leaves are more variable in shape varying from ovate or elliptic to linear-oblong or narrow ovate-oblong (usually less than 12 times longer than wide), the stems are often procumbent or prostrate, and the pod valves are usually pubescent throughout externally at least when young. Although material of typical *H. linearis* and typical *H. heterophylla* looks different, the extremes are linked and the two cannot be maintained as distinct species. Initial studies suggested that it would be possible to accord each variant formal infraspecific rank within *H. linearis* on the basis of a combination of the ratio of leaf length to leaf width and the degree of pubescence of the external surface of the pod valves. However, subsequent studies revealed the nature of the variation to be more complex and consequently the extremes are not recognized formally.

Typical *H. linearis* from the central coastal areas of New South Wales occurs within the distributional range of *H. longifolia* and some specimens of the two species are superficially similar. *H. longifolia* differs in having a different indumentum on the young stems and lower surfaces of the leaves, flowers on pedicels 4-6 mm long, the bract on the pedicel usually inserted 2.5-4 mm below the bracteoles, and grows as a large shrub.

Some specimens of *H. linearis* are superficially similar to the Western Australian *H. trisperma*. The latter differs in the nature of the indumentum on the young stems and lower surfaces of the leaves, in having larger flowers with an intense purplish-blue corolla, and glabrous pods.

REPRESENTATIVE SPECIMENS (total number examined 271)

SOUTH AUSTRALIA: Lower South East, 3.2 km S of Comaum Forest HQ, 3 Aug. 1966, *I.B. Wilson 497* (AD).

QUEENSLAND: Leichhardt Distr., Blackdown Tableland, ca 35 km SE of Blackwater, 3 Sep. 1971, *R.J. Henderson, L. Durrington & P. Sharpe 935* (BRI, MEL, NSW).

NEW SOUTH WALES: Port Jackson, 1836, *Sieber 375* (MEL, PRC, W).

AUSTRALIAN CAPITAL TERRITORY: 3 km ENE of Canberra City, NW slopes of Mt Ainslie, 2 Sep. 1983, *M.D. Crisp 7163* (CBG, MEL).

VICTORIA: beside Ferntree Gully railway line, 0.8 km E of Ringwood, 11 Dec. 1960, *T.B. Muir 2011* (MEL).
TASMANIA: SE of Epping Forest, 6 Sep. 1967, *J.H. Hemsley 6174* (HO, MEL, NSW).

2. *Hovea longifolia* R.Br. in W.T.Aiton, *Hortus Kew.* edn 2, 4:275 (1812); Edwards, *Bot. Reg.* 8: t. 614 (1822); DC., *Prodr.* 2: 115 (1825); Thompson & Lee in Lee & Thompson, *Fl. New South Wales* 101(2): 139 (1984). *Phusicarpos longifolia* (R.Br.) Poir. in Lamarck & Poiret, *Encycl. méth. Bot.* suppl. 4: 400 (1816). TYPE: New South Wales, Port Jackson, R. Brown. LECTOTYPE (**here selected**): BM; ISOLECTOTYPES: E, MEL 1520374. *Hovea racemulosa* Benth. in Lindley, *Edwards Bot. Reg.* 28: 39, misc. no. 36 (1842); Lindley, Edwards *Bot. Reg.* 29: t.4 (1843). TYPE: raised from seed from New South Wales (the alleged Swan River origin is incorrect), LECTOTYPE (**here selected**): K. *Hovea longifolia* R.Br. var. *normalis* Benth., *Fl. Austral.* 2: 173 (1864) *pro parte quoad specim.* 'Port Jackson, R. Brown, Sieber n. 376'. *Hovea longifolia* R.Br. forma *albiflora* Domin, *Biblioth. Bot.* 22 (89^2): 729 (1925) *nom. nud.*

Shrub to 3 m high; branchlets densely clothed with a short understorey of curled or crinkled hairs and longer projecting hairs or sometimes the long hairs appressed and concealing any understorey. *Leaves*: lamina usually arched up on either side of the midrib and recurved so as to appear linear-oblong or oblong, (1.2-)2-8.5(-11.2) cm long, 0.18-0.85 cm wide, upper surface glabrous, glossy, the venation not raised and unduly prominent, lower surface densely clothed with an understorey of coiled or curled hairs from which scattered longer hairs project or the hairs exclusively curled or coiled and discontinuous, the hairs usually ferruginous at least on the midrib; petiole 2.5-4 mm long, densely pubescent like the branchlet. *Stipules* subulate, 1-1.5 mm long, densely pubescent, soon deciduous. *Inflorescences* axillary, subsessile or on peduncles up to 3 mm long, usually 2- or 3-flowered or sometimes the axis growing on to form a leaf-bearing shoot. *Flowers* pedicellate, the pedicels 4-6 mm long, densely clothed with long hairs which project beyond shorter curled or crinkled hairs; bracteoles ovate to oblong, 1-2 mm long, shorter than the calyx-tube, sometimes inserted a short distance below the calyx, densely pubescent like the pedicel and bract; bract 1-2 mm long, inserted (1.5-) 2.5-4 mm below the bracteoles. *Calyx* densely clothed with short coiled or curled often ferruginous hairs and longer straighter hairs: 2 upper lobes 4-5 mm long including the tube 2-2.5 mm long; the 3 lower lobes 1.3-2 mm long, the central one often somewhat reflexed. *Standard* 6.8-8.5 mm long including a claw 1.8-2.5 mm long, 8.5-9.5 mm wide, usually broader than long, slightly emarginate apically, pale mauve; wings 6-7.5 mm long including a claw 1.5-2 mm long, 2.6-3.2 mm wide; keel petals 4.5-5.2 mm long including a claw 1.5-2 mm long, 2-2.4 mm wide. *Stamen-filaments* 3.7-5.2 mm long. *Ovary* subsessile, 1.2-1.5 mm long, 2-ovulate. *Pods* sessile, obliquely globular, ovoid or ellipsoid or sometimes transversely elliptic, 0.8-1.7 cm long, 1-1.3 cm wide, densely clothed with curled ferruginous hairs externally when young and with weak white hairs internally. *Seeds* elliptic, plump, 5.5-6 mm long, 3.25-3.5 mm wide, 3-3.5 mm thick, black, hilum linear, the aril extending for almost the length of the seed. (Fig. 3)

DISTRIBUTION AND ECOLOGY

Occurs in coastal areas of New South Wales from Port Stephens in the north southwards to the foothills of the Southern Tablelands SW of Mt Walimma, just north of the Victoria border (Fig. 4). One specimen (NSW 166488) with a label bearing the locality 'Stanthorpe, Queensland' is a mixed gathering consisting of 5 twigs of *H. linearis* and one of *H. longifolia*. This is the only record of *H. longifolia* from Queensland and as it is so far removed from the nearest known population of the species the most likely explanation is that the label belongs with the specimens of *H. linearis* and that the specimen of *H. longifolia* was inadvertently mixed in with them. This suggestion is supported by the presence in other herbaria of apparent duplicates. collections distributed from NSW which consist entirely of specimens of *H. linearis*.

Recorded from sandy soil in dry and in wet sclerophyll forest, dry sclerophyll forest on sandstone, rocky sandstone outcrops and moist alluvial deposits along creeks and in shaded gullies.

TYPIFICATION

It is not clear whether R. Brown based his description of *H. longifolia* on a plant raised at Kew Gardens from seed introduced by himself in 1805 from New South Wales, whether the description was based on his specimens collected in Australia, or whether it was based on both. There is in BM a specimen of *H. longifolia* with the name 'Poiretia ferruginea' in pencil at the foot of the sheet from a plant cultivated at Kew but, as the specimen is undated and there is no means of establishing when it was collected and by whom, it is not considered for the purpose of typification.

There are in BM two sheets collected by R. Brown labelled as type collections of *H. longifolia*. One has a typed label in the upper left hand corner indicating that it was collected at Port Jackson and a printed blue label headed 'R. Brown, Iter Australiense 1802-5' in the bottom right hand corner bearing the number 5082 and in Bentham's hand 'Hovea longifolia R. Br.'. The second sheet has a typed label almost midway down the left hand side of the sheet bearing the locality 'Queensland: Port Clinton (Port II)' and the date 'Aug. 22nd. 1802', and in the bottom left hand corner in R. Brown's hand a label the verso of which reads 'Port II Shoal water bay passage' and a third small label with the name 'Hovea longifolia R. Br.' in Bentham's hand.

The two sheets in BM represent different taxa. As Brown stated in the protologue that *H. longifolia* was a native of New South Wales this eliminates the specimen collected at Port Clinton in Queensland as a type. However, the possibility exists that the seeds introduced into cultivation at Kew Gardens by Brown came from either or both New South Wales and Queensland plants. In order to obviate any confusion, the specimen numbered 5082 from Port Jackson referred to above is here selected as the lectotype of *H. longifolia*. The Port Clinton specimen represents an unnamed taxon that occurs in the Port Curtis District.

The MEL specimen (1520374) labelled as having been collected by R. Brown at Lane Cove is a good match of the lectotype in BM and is regarded as an isolectotype.

NOTES

Bentham, *Fl. Austral.* 2:172 (1864), treated *H. longifolia* as an 'omnibus species' by including in it several species that had been regarded formerly as specifically distinct. Because of this broad concept of *H. longifolia* adopted by Bentham, the name has been used widely since for plants from South Australia, Queensland, New South Wales, Victoria and Tasmania. However, it is clear now that *H. longifolia* is confined to New South Wales where it has a fairly restricted distribution.

Hovea longifolia is a relatively uniform species which is characterised by long linear-oblong or oblong narrow leaves and flowers on long pedicels with the bract usually inserted 2.5-4 mm below the paired bracteoles.

The northern limit of distribution of *H. longifolia* is a little south of the southern limit of distribution of *H. acutifolia*. Occasional specimens, for example *Burgess NSW 168360*, MEL 1558625, occur near the southern limit of distribution of *H. acutifolia* which, in the absence of flowers and fruits, bear a strong superficial resemblance to *H. longifolia* and are difficult to place with certainty. *Burgess NSW 168360* from the Manning River National Forest is sterile; all that remains are the long pedicels and the persistent bases of the calyces following the fall of the pods. *Burgess NSW 168360* bears a strong resemblance to *Burgess NSW 166424* in a similar stage of development from Glenbrook west of Sydney. There appears to be little doubt that *Burgess NSW 166424* is referrable to *H. longifolia*. Despite the similarities between the two specimens, *Burgess NSW 168360* is referred with some doubt to *H. acutifolia*. Examination of the plants in the field would undoubtedly clarify the matter but these specimens illustrate the difficulty of naming incomplete atypical herbarium specimens in this genus.

The differences between *H. longifolia* and *H. linearis* are discussed under the latter.

Fig. 3. *Hovea longifolia*. a - flowering twig, x1. b - section of stem showing a dense understorey of curled hairs and longer projecting hairs, x5. c - pedicel showing insertion of the bracteoles and the basal bract, x4. d - calyx opened out (upper lobes on right), x4. e - standard, x4. f - wing petal, x6. g - keel petal, x6. h - gynoecium x6. i - fruiting twig, x1. j - seed, side view, x5. k - seed, hilar view, x5. a-c from *Adams 658* (MEL), d-h from *Albrecht 3294* (MEL), i-k from *Salasoo 2664* (NSW).

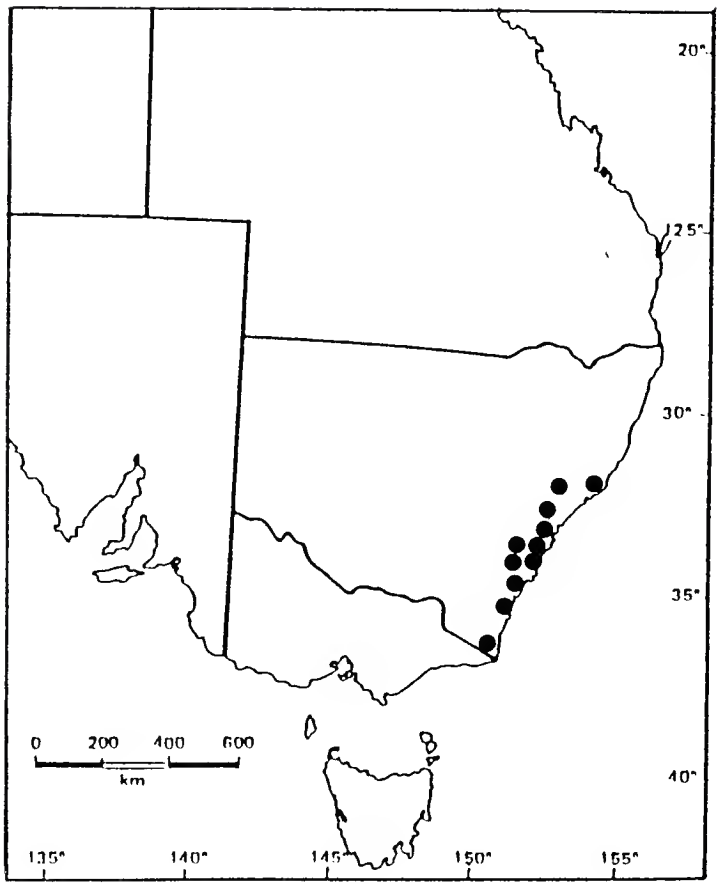

Fig. 4. Distribution of *Hovea longifolia*.

REPRESENTATIVE SPECIMENS (total number examined 82)

NEW SOUTH WALES: 8 km SE of Clyde Mountain, near Batemans Bay, 11 Sep. 1963, *L.G. Adams 658* (CANB, MEL, NSW). Tahlee, Port Stephens, 23 Oct. 1956, *E.F. Constable* (NSW 166446). Cumberland State Forest, West Pennant Hills, 29 Oct. 1976, *R. Coveny 8526* (MEL, NSW). Bent's Basin, 8.1 km S of Wallacia, 9 Sep. 1971, *B. Stevenson & R. Coveny 3642* (AD, HO, MEL, NSW). 5 km SE of Wingello, 12 Nov. 1973, *I.R. Telford 3638* (CBG, NSW). 0.5 km SW of Mt Walimma trig, 30 Aug. 1987, *D.E. Albrecht 3294* (CBG, MEL, NSW).

3. *Hovea acutifolia* A.Cunn. ex G.Don, *Gen. Hist.* 2: 126 (1832); Benth., *Fl. Austral.* 2: 174 (1864); Stanley & E. Ross, *Fl. South-eastern Queensland* 1: 270 (1983); Thompson & Lee in Lee & Thompson, *Fl. New South Wales* 101(2): 137 (1984). TYPE: New South Wales, W of Mt Warning, 1827, *A. Cunningham 160.* LECTOTYPE (**here selected**): BM; ISOLECTOTYPE: NSW.

Shrub or slender tree to 4 m high; branchlets densely clothed with curled, crinkled or straightish hairs, sometimes with longer almost straight hairs projecting beyond a shorter understorey, occasionally the majority of hairs spreading and villous, hairs usually ferruginous or grey. *Leaves*: lamina more or less flat on upper surface on either side of a depressed midrib or raised on either side of the midrib and broadly V-shaped in section, sometimes the margins slightly recurved, usually broadest at or near the middle and tapering evenly towards the apex and base but sometimes obtuse apically, elliptic or sometimes elliptic-oblong or occasionally obovate, 2.5-8(-10) cm long, 0.4-2.7 cm wide, upper surface finely reticulate, the primary lateral veins not obviously

distinct from the smaller veins, glabrous, lower surface densely clothed with curled or crinkled ferruginous hairs or with an understorey of curled or crinkled hairs beyond which longer crinkled or straight hairs project, the hairs completely obscuring the venation or the primary lateral veins and smaller ones conspicuously raised and visible through the hairs, sometimes the hairs confined to the veins and forming a pattern through which glabrous patches of lamina are visible; petiole 2-5 mm long, densely pubescent like the branchlet. *Stipules* subulate, (1-)1.5-2(-3) mm long, densely pubescent, soon deciduous. *Inflorescences* axillary, subsessile or on peduncles up to 4 mm long and usually 1-3-flowered or sometimes growth extending from apex of peduncle and inflorescence many-flowered, rarely pseudoracemose. *Flowers* pedicellate, the pedicels 1.5-4 mm long, densely pubescent like the branchlet; bracteoles narrow-ovate, 1.5-4 mm long, subacute or occasionally obtuse apically, much shorter than to almost as long as the calyx-tube, inserted at the base of or a short distance below the base of the calyx, pubescent throughout like the pedicel; bract 1-3 mm long, inserted 1-2.5 mm below the bracteoles, the apex usually overlapping the base of the bracteoles. *Calyx* densely clothed with coiled or crinkled ferruginous hairs and scattered longer often paler crinkled or straightish hairs; upper lip 4.2-5.5 mm long including the tube 2-3 mm long; the 3 lower lobes 1.8-2.5 mm long, 1.5-2 mm wide, deltoid. *Standard* 9-10.5 mm long including a claw 2-2.8 mm long, 9-13 mm wide, usually slightly wider than long, mauve with a greenish-yellow basal flare; wings 7.5-9 mm long including a claw 2-2.5 mm long, 3-4.4 mm wide; keel petals 5-5.5 mm long including a claw 1.8-2.4 mm long, 2-2.6 mm wide, auricled. *Stamen-filaments* 3.2-5.8 mm long. *Ovary* sessile or subsessile, 1.5-2 mm long, 2-ovulate. *Pods* on a stipe up to 1 mm long, obliquely ellipsoid, ovoid or globular, sometimes transversely so, 0.9-1.6 cm long, 0.9-1.2 cm wide, densely clothed with curled ferruginous hairs externally when young but glabrescent, sparingly to densely clothed with curled or straightish hairs internally. *Seeds* blackish, plump, 4.5-6.5 mm long, 3-3.6 mm wide, 2.9-3.3 mm thick, hilum linear, the aril extending for almost the length of the seed or for the entire length of the seed. (Fig. 5)

DISTRIBUTION AND ECOLOGY

Occurs in southern Queensland and northern New South Wales from Fraser Island in the north to the Manning River in the south.(Fig. 6). Mainly a coastal species which favours rainforest margins, edges of swampforest or similar favourable conditions such as stream banks and fertile soil but also recorded from sandy heath and coastal wallum, wet sclerophyll forest, open *Eucalyptus* forest and stony hillsides.

TYPIFICATION

The description of *H. acutifolia* was based in part at least, if not entirely, on material collected by Cunningham. There are at K two specimens labelled as having been collected by Cunningham at Mt Lindsay (Mt Barney, *fide* Telford, 1990), New South Wales, in 1828. Both specimens came via R. Heward; the specimen numbered 160 mounted in the top left hand corner of the sheet was presented to K by Heward in 1862 and the other, also mounted on the left hand side of a sheet but lacking a collecting number, was presented to K in 1915 by the Linnean Society of London which had earlier acquired it from Heward. Two sheets collected by Cunningham are present in BM. Both are numbered 160 and are labelled as having been collected in 1827 W of Mt Warning. A duplicate from BM is present in NSW.

The two specimens at K were collected a year later and from a different locality to the two specimens at BM, but the four specimens and the duplicate in NSW from BM are regarded as syntypes of *H. acutifolia*. I here select the specimen in BM mounted on the left hand side of the sheet (the right hand side of the sheet is occupied by a specimen collected by G. Podenzana from Brisbane in Oct. 1891) from among the syntypes as the lectotype of *H. acutifolia*.

NOTES

In its typical form, *H. acutifolia* is distinguished readily from other eastern state species by its distinctive broad (usually 1-2.4 cm wide) elliptic leaves which are broadest at or near the middle and taper evenly to each end. Occasionally, and especially on Fraser Island, the leaves are narrow (0.4-0.6 cm wide), for example *Walsh 1386* (MEL), but, as many are still distinctly elliptic the specimens are referrable to *H. acutifolia* without difficulty. In New South Wales, and often near the southern range of distribution of the species, the leaves are narrow (less than 0.8 cm wide) linear-oblong, oblong or slightly obovate-oblong, for example *Burgess NSW 168361* from the Manning River National Forest, *Coveny NSW 168358* from Bird Lime Tree, c. 9.6km W of the Pacific Highway, *Maiden & Boorman NSW 168362* from Ellenborough Falls, and such specimens are reminiscent of *H. longifolia*. When in flower the specimens are distinguished readily from *H. longifolia* as the flowers are on shorter pedicels, the bracts and bracteoles are longer and the distance between the points of insertion of the bracteoles and bract on the pedicel is less. Some sterile specimens are more difficult to place with certainty and reference to them is made under *H. longifolia*.

Of greater concern are specimens, for example *Constable 7046* (NSW) from Old Man Gibber Mountain, *Blaxell NSW 168370* from Little Styx River near Ebor, *Blakely & Shiress NSW 168354* from the Orara River, 16 km S of Ramornie, which are reminiscent of *H. pannosa*. Typical *H. pannosa* is readily distinguishable from typical *H. acutifolia* but the range of morphological variation encountered within each species, and especially within *H. pannosa*, tends to obscure the limits of each species and makes it exceedingly difficult to place some specimens with certainty. Fortunately the number of specimens in question is quite small (less than 2.5% of specimens examined in *H. acutifolia* and *H. pannosa)*. It is likely that examination of the plants in the field would enable these difficult specimens to be placed quite readily. My inclination is to refer *Constable 7046* and *Blakely & Shiress NSW 168354* to *H. acutifolia* as some of the flowers in each specimen are on distinct peduncles, a feature common in *H. acutifolia* but infrequent in *H. pannosa*. The placement of *Blaxell NSW 168370* is more problematical and it is referred with some doubt to *H. acutifolia*. The relationship of *H. acutifolia* to *H. pannosa* and to some other taxa in southern Queensland requires clarification.

REPRESENTATIVE SPECIMENS (total number examined 221)

QUEENSLAND: Moreton District, Oxenford, S of Brisbane, 17 Aug. 1930, *C.E. Hubbard 3691* (BRI). Moreton District, 4.7 km W of Beerwah on road to Peachester, 25 Aug. 1986, *J.H. Ross 3150* (BRI, CBG, MEL). Wide Bay District, Fraser Island, western shore of Lake Garawongera, Aug. 1984, *N.G. Walsh 1386* (BRI, MEL).

NEW SOUTH WALES: Pimlico, 8 km SW of Ballina, 23 Oct. 1961, *E.F. Constable 1401* (BRI, MEL, NSW). Broken Head, 8 km S of Byron Bay, 24 May 1962, *E.F. Constable 3013* (BRI, MEL, NSW). Brunswick Heads, 28 Aug. 1972, *R. Coveny 4302 & J. Armstrong* (CANB, CBG, MEL, NSW).

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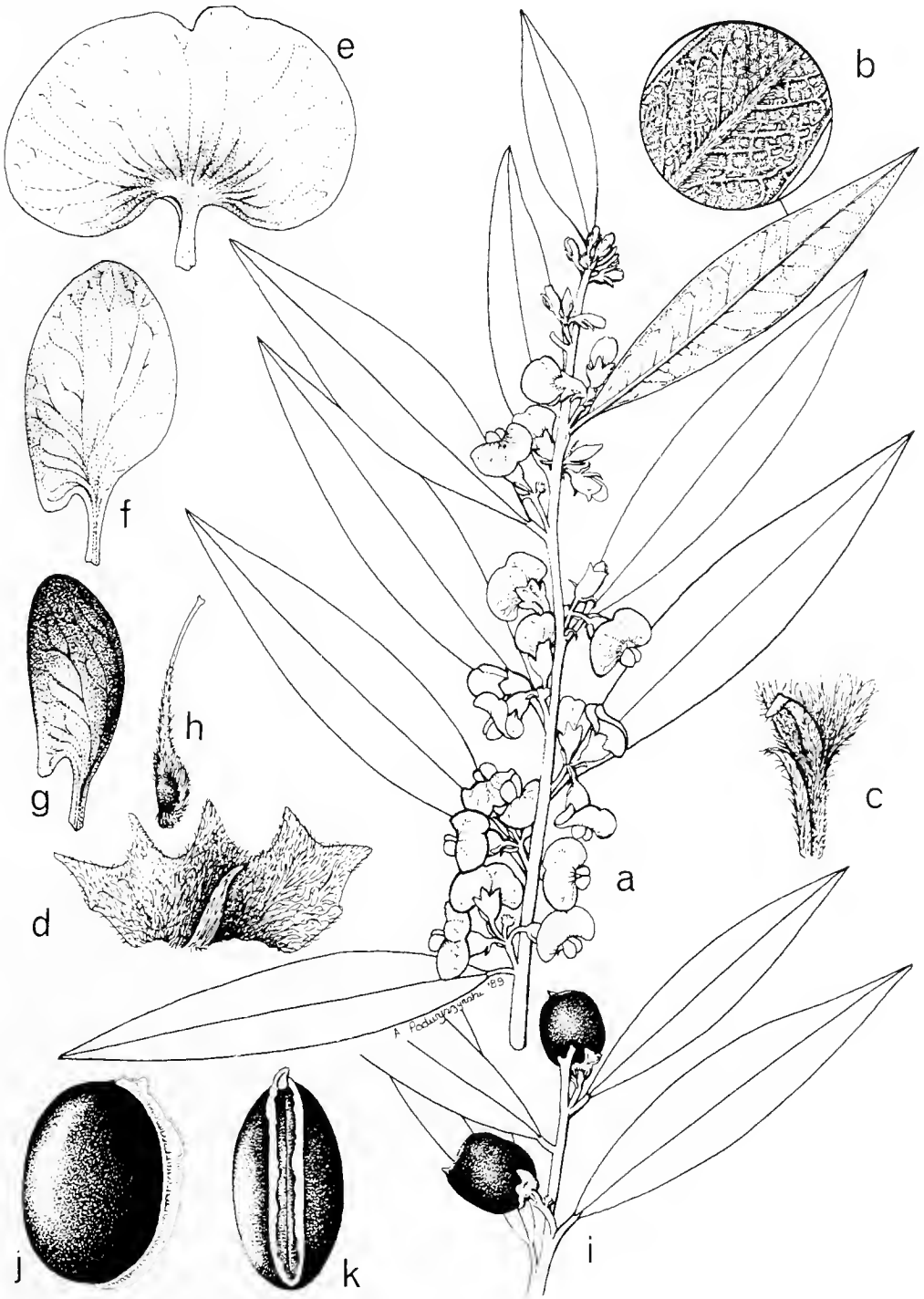

Fig. 5. *Hovea acutifolia*. a - flowering twig, x1. b - lower surface of leaf showing venation and disposition of indumentum, x2.5. e - pedicel showing insertion of bracteole and basal braet, x4. d - calyx opened out (upper lobes on right), x4. e - standard, x4. f - wing petal, x6. g - keel petal, x6. h - gynoeeium, x6. i - fruiting twig, x1. j - seed, side view, x5. k - seed, hilar view, x5. a-d from *Hubbard 3088* (MEL), e-h from *Ross 3150* (MEL), i-k from *Constable 6516A* (NSW).

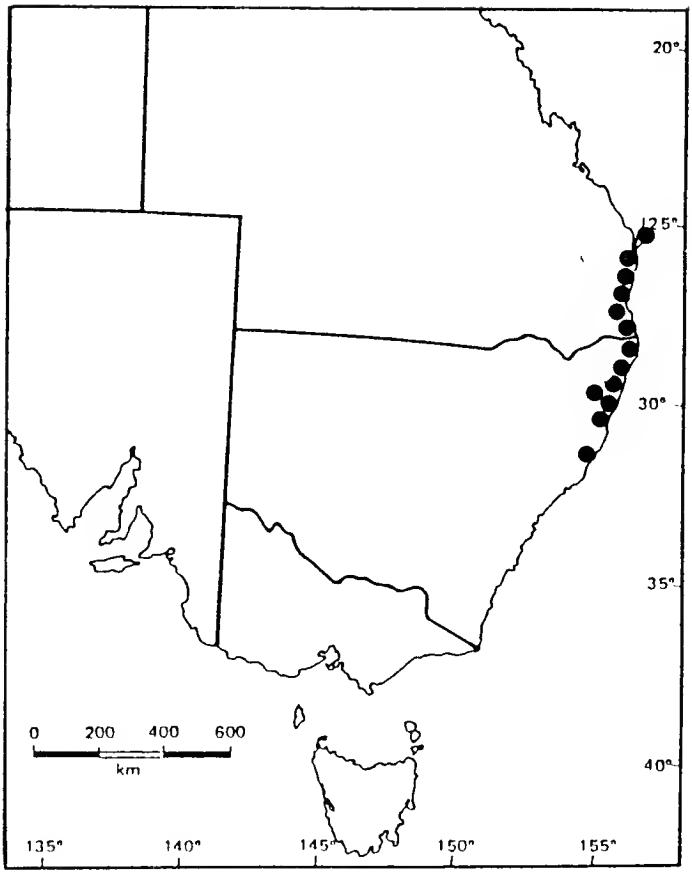

Fig. 6. Distribution of *Hovea acutifolia*.

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Ectocarpus siliculosus (Dillwyn) Lyngb. from Hopkins River Falls, Victoria - the first record of a freshwater brown alga in Australia

John A. West & Gerry T. Kraft

School of Botany, University of Melbourne, Parkville, 3052, Victoria, Australia.

ABSTRACT

Ectocarpus siliculosus was collected on 24 March 1995 at Hopkins River Falls, Victoria. (38°20'S, 142°37'E) This site is about 25 km from the river mouth at Warnambool and about 40 m above sea-level. It grows well and reproduces by plurilocular sporangia in laboratory culture at 5, 15 and 30% salinity, 15, 20 and 25°C and 10-30 µmol m^{-2} s^{-1} irradiance. This is a first record of a brown alga occurring in freshwater in the southern hemisphere.

Introduction

The brown marine algae are frequently associated with salt marshes and mangroves in Australia (Womersley 1987, King 1981). These are subjected to extensive salinity variation from freshwater to full seawater (0-40%). However no phaeophytes have been observed in a fully freshwater habitat in Australia (Entwisle 1994) or anywhere else in the southern hemisphere although several genera are known in the northern hemisphere (Bourrelly 1968). The crustose species *Heribaudiella fluviatilis* (Areschoug) Svedelius of the Lithodermataceae is widely distributed in freshwater streams of the northern hemisphere (Yoshiaki *et al.*1984, Wehr and Stein 1985, West 1990). Among the filamentous genera of the Ectocarpaceae *Bodanella* is recorded from Lake Constance, Switzerland and *Pleurocladia* is known from several localities in Scandinavia, Germany and France. Thus far *Ectocarpus* is unknown in truly freshwater habitats although it sometimes occurs in the saltwater intrusions of rivers in Germany (D. Müller, personal communication).

Materials and methods

The collection data are as follows: 24 March 1995. Hopkins River Falls, (38°20'S, 142°37'E) Victoria (Fig. 1) . This is a 15 meter high water fall about 25 km from the river mouth at Warnambool and about 40 m above sea level. *Ectocarpus* was growing with the red alga *Caloglossa leprieurii* (Montagne) J.Agardh and various green algae including *Mougeotia* and *Cladophora* between the cracks in the basalt rock river bed at the top of the falls. The few filaments of *Ectocarpus* available in the collection were non-reproductive. Water temperature was 16°C. Irradiance at 6:00 p.m. was 1500-1600 µmol m^{-2} s^{-1} as measured by a Li-Cor Radiometer (Model LI-189) equipped with a flathead quantum sensor. Salinity was 1.0 ppt as measured by a Reichert Automatic Temperature Compensated Hand Refractometer (Model 10419). Conductivity was 3.0 mS s^{-1} as measured by a Hanna Portable Conductivity Meter (Model HI 8733).

Living material was placed in a 120 ml screw cap polyethylene sample cup in a cool chest for two days before transport to the university and then held in a plant growth cabinet (Percival I-30 LL) at 15°C, 12:12 LD photoperiod in 10 µmol m^{-2} s^{-1} coolwhite fluorescent lighting for several days. During this time plurilocular sporangia developed and released many spores which germinated to form small thalli that were then isolated into separate containers. Stocks were maintained in stationary (not aerated

Fig. 1. Habitat of *Ectocarpus siliculosus* at Hopkins River Falls, Victoria.

or agitated) eultures of 5 ppt seawater [Provasoli Enriehed Seawater-(PES/2 with 10 ml enriehment per liter) - see Starr and Zeikus 1993] in 300 ml Pyrex No. 3250 deep storage dishes at 15°C, 12:12 LD photoperiod in 15 µmol m^{-2} s^{-1}. Experimental eultures were plaeed in 100 ml Pyrex No. 3140 dishes with 5, 15 and 30 ppt seawater (PES/2) in 15°C on a 75 rpm New Brunswiek Gyrotory Model G-2 shaker at 15µmol m^{-2} s^{-1} eoolwhite fluoreseent lighting, 12:12 LD photoperiod for 15 days to determine the growth and reproduetion. Additional experiments were undertaken in 20 and 25°C at 15µmol m^{-2} s^{-1}, in stationary eulture to determine any ehanges in growth and reproduetion.

Cultured speeimens are available from the first author. Voueher herbarium speeimens of eultured thalli are deposited with the National Herbarium of Vietoria (MEL 2025930).

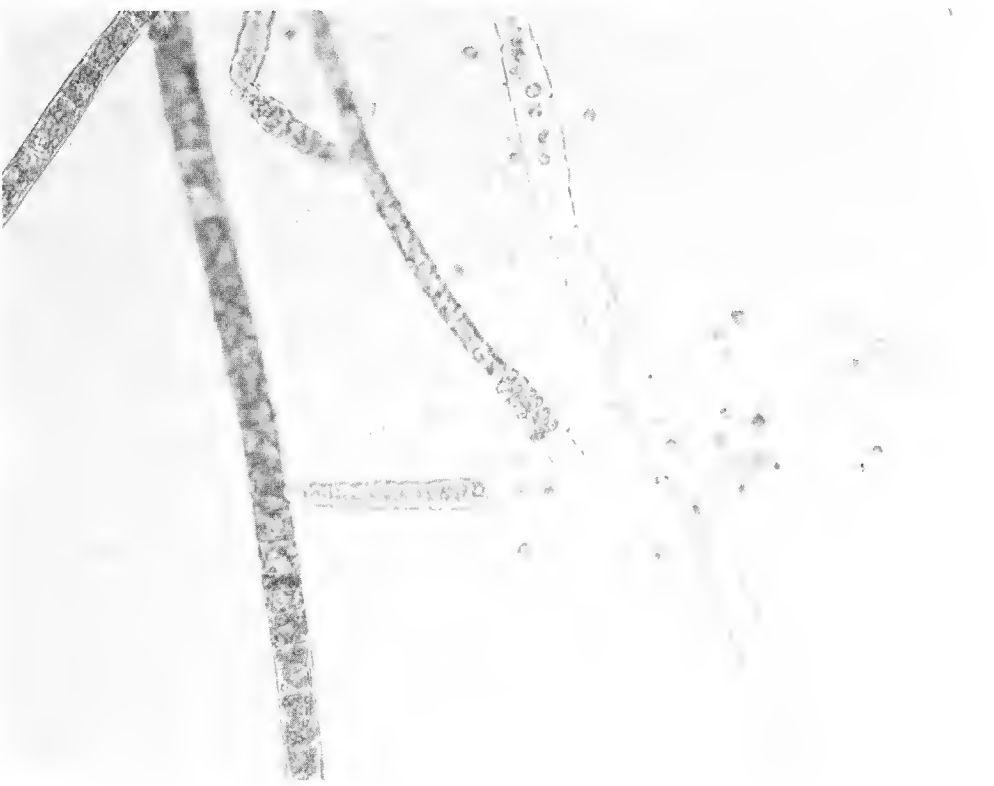

Fig. 2. Sporangia of *Ectocarpus siliculosus* growing in culture.

Results

Growth and reproduction in culture (Fig. 2) were satisfactory in all the water motion, irradiance, temperature and salinity conditions tested indicating that the population from Hopkins Falls is still adapted to a wide range of conditions comparable to those in different field conditions where fully marine populations occur. Spores from the plurilocular sporangia germinated readily in all conditions giving rise to new sporophyte plants that also formed plurilocular mitosporangia. Unilocular meiosporangia were not observed under any conditions tested here. The development from the initial spore germination to fully mature reproductive sporophyte requires only 3-4 weeks in all conditions used here.

The general characters of the thallus appear to change little in culture as indicated in Table 1.

Discussion

Although many other *Ectocarpus* species are known elsewhere only two, viz. *E.siliculosus* (Dillwyn) Lyngbye and *E.fasciculatus* Harvey, are recognized from Southern Australia (Womersley 1987). The primary character used in distinguishing the two species is the scattered elongate plurilocular sporangia of *E.siliculosus* and the

clustered ovoid plurilocular sporangia of *E.fasciculatus*. Müller (personal communication) cautions that the sporophyte morphology is not always reliable in separating the two species and he 'gives species assignment only in cases where he has the full life history in culture'. Müller and Eichenberger (1994) also rely on the presence of the betaine lipid DGTA (diacyldiglycerylhydroxymethyl-trimethyl-ß-alanine) in *E.fasciculatus* and its absence in *E.siliculosus*. Crossing experiments between the two species were also not successful (Müller and Eichenberger 1995) indicating that the two species are genetically incompatible.

As indicated in Table 1 there are minor differences in the morphology between field-collected and laboratory-cultured specimens but these are not sufficient to question the species identification because these characters, particularly filament diameter and sporangial shape and size do change somewhat in laboratory culture because of the changes in water motion, irradiance and salinity levels. It is possible that a lower temperature of 10°C may be sufficient to stimulate unilocular meiosporangial development as is needed for the marine populations of *Ectocarpus siliculosus* from Europe (Müller 1967).

Acknowledgements
We appreciate the helpful comments of Prof. Robert King (UNSW) on the occurence of *Ectocarpus siliculosus* in mangroves and estuaries throughout Australia

TABLE 1. COMPARISON OF CHARACTERS OF *ECTOCARPUS SILICULOSUS* IN FIELD AND CULTURE .

Character	**Field** (Womersley 1987)	**Culture**
habitat	epiphytic, epilithic	not applicable
thallus length	1-15 cm	1-12 cm
meristem	intercalary, diffuse	intercalary, diffuse
branching	irregular throughout	sparse to irregular
filament diameter (µm)	20-40	15-24
terminal false hairs	present	present
diameter (µm)	8-12	9-10
plurilocular sporangia		
shape	elongate-conical to narrow linear	narrow linear
length (µm)	70-160	190-570
diameter (µm)	20-35	15-21
terminal false hair	5-10 cells	5-8 cells
chloroplasts	several elongate, lobed and parietal, each with several pyrenoids	several elongate, lobed and parietal, each with several pyrenoids

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Muelleria 9: 35–36 (1996)

New combination in *Viola* (Violaceae)

T.A. James

Royal Botanic Gardens, Sydney, Mrs Macquaries Road, Sydney, 2000, New South Wales, Australia.

ABSTRACT
Viola hederacea subsp. *fuscoviolacea* is recognised as a distinct species; an illustration and a new combination are provided.

Introduction

Adams (1982) recognised eight subspecies within the *Viola hederacea* complex in Australia, including *V. hederacea* subsp. sieberiana, a taxon previously recognised as a distinct species (Sprengel 1827). Both earlier and subsequent treatments (Willis 1973; Curtis 1975; Seppelt 1986; James 1990) have retained *V. sieberiana* at specific rank, despite a varietal combination available under *V. hederacea* (Domin 1928), and in keeping with cytological, morphological and biochemical evidence (Seppelt 1986). Morphologically at least, three of the other subspecies recognised by Adams, show closer affinites to *V. sieberiana* than to *V. hederacea*. The leaves are consistently ovate to rhombic in shape, as wide as long or longer and the base cuneate and tapering into the petiole. The flowers are concolorous and the petals <7 mm long. In comparison the leaves of *V. hederacea* are reniform to almost circular, often broader than long and mostly truncate or cordate at the base; the flowers are mostly discolorous with petals 7-10 mm long. Despite the uniformity of characters within the *V. sieberiana* alliance, taxa can be readily distinguished on the basis of flower colour and size and the length of the flower scape. *Viola hederacea* subsp. *cleistogamoides* (Adams 1982) has been formally raised to specific rank (Seppelt 1986). *Viola hederacea* subsp. *fuscoviolacea* is recognised as a distinct species (*V.* sp. A) in the *Flora of New South Wales* (James 1990) but requires a new combination.

Taxonomy

Viola fuscoviolacea (L.G.Adams) T.A.James, *comb. & stat. nov.*
Viola sp. A *sensu* T.A.James, *Fl. New South Wales* 1: 438 (1990).

Viola hederacea subsp. *fuscoviolacea* L.G.Adams, *Fl. Australia* 8:386 (1982) basionym.
TYPE: Victoria: Buckety Plain, Bogong High Plains, 36°56'S, 147°21'E, 6 Jan. 1972, *L.G. Adams 2641* (HOLOTYPE: CANB; ISOTYPES: K, MEL)

Perennial herb, usually glabrous; stems short; stolons well-developed. *Leaves* tufted; lamina broad-ovate to ovate-rhombic, 5-15 mm long, 4-10 mm wide, base cuneate (or rarely almost truncate), tapering to petiole, margins scalloped to coarsely toothed, apex obtuse; petioles narrowly winged, 1-3 cm long; stipules free, linear-lanceolate, 1-5 mm long, glandular-denticulate. *Flower-scapes* 2-25 mm long, shorter than or just exceeding leaves; bracteoles mostly below middle. *Sepals* lanceolate, 1.5-3 mm long, acute, basal appendages small. *Petals* 2-3 mm long, blackish-violet (rarely paler); lower petal obovate-elliptic, c. 2 mm wide, without spur; lateral petals entire, bearded. *Capsule* ovoid, 4-7 mm long. (Fig. 1)

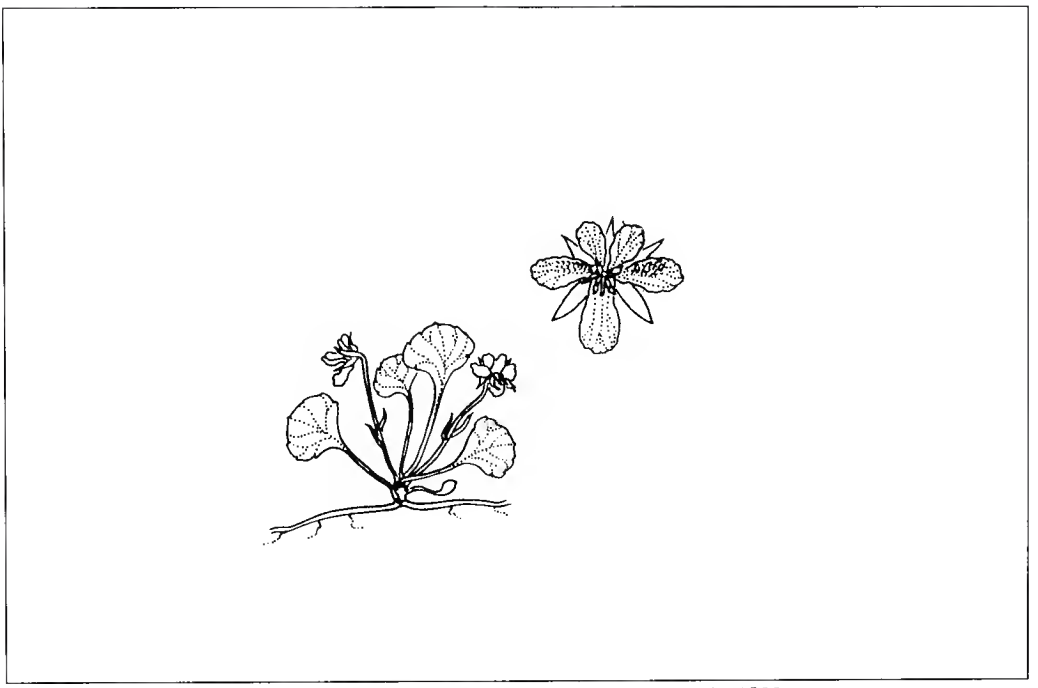

Fig. 1. Habit study of *Viola fuscoviolacea*. Reproduced from G.J. Harden (ed) (1990).

FLOWERING PERIOD

Mostly November to January.

DISTRIBUTION AND HABITAT

Occurs in damp sites at edge of montane peatland or in alpine herbfields, often along creeks. Tablelands of New South Wales; Victoria and Tasmania.

ETYMOLOGY

The name is derived from Latin *fuscus* = dark, *violaceus* = violet, referring to the colour of the corolla (Adams 1982).

Acknowledgements

The author is indebted to Dr. Tim Entwistle for initiating this paper and I thank Dr. Peter Wilson for comments. The illustration is reproduced with kind permission from Harden 1990.

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Muelleria 9: 37–40

A new species of *Asplenium* L. section *Thamnopteris* C.Presl (Aspleniaceae) from Lord Howe Island

David L. Jones

Centre for Plant Biodiversity Research, G.P.O. Box 1600, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT

Asplenium goudeyi, from Lord Howe Island and related to *Asplenium australasicum* (J.Sm.) Hook., is described and illustrated.

Introduction

The opportunity is taken here to formally describe a fern, related to *Asplenium australasicum* (J.Sm.) Hook., that has become a popular horticultural subject in Victoria and New South Wales. The distinctiveness of the new species was recognised by Chris Goudey from Lara, Victoria, after he grew for a number of years plants that were originally collected on Lord Howe Island. Cultivated plants of *A. australasicum* and the new species contrast strikingly in growth habit as well as frond features including size, colour and texture. Holttum (1974) has drawn attention to the importance of growth habit in the taxonomic delimitation in this group of ferns and this was supported by the recognition of *A. harmanii* (Jones 1988). Green (1994) noted that the Lord Howe Island plants have 'a narrower, more erect habit, with thicker, more obtuse, glaucous fronds than those elsewhere', but concluded that more comparative observations were required.

Methods

Cultivated plants of *Asplenium australasicum* from various locations in eastern Australia and the new species from Lord Howe Island have been grown in close proximity for five years in the glasshouses at the Australian National Botanic Gardens (ANBG), Canberra. Sporelings of both taxa, raised through two generations by Chris Goudey, have been found to maintain their individual characteristics. Samples of these progeny have been grown at the ANBG. Measurements given in descriptions are from living plants or from herbarium specimens. Notes on habitat were derived from my own field studies and those of Chris Goudey.

Taxonomy

Asplenium goudeyi D.L.Jones, *sp. nov.*

affinis *Asplenium australasico* (J.Sm.) Hook., sed frondibus brevioribus magis coriaceis obscure viridibus aliquantum glaucis in rosula magis erecta; costis cinereo-viridibus; et stipite cum porca dorsali obscura, differt.

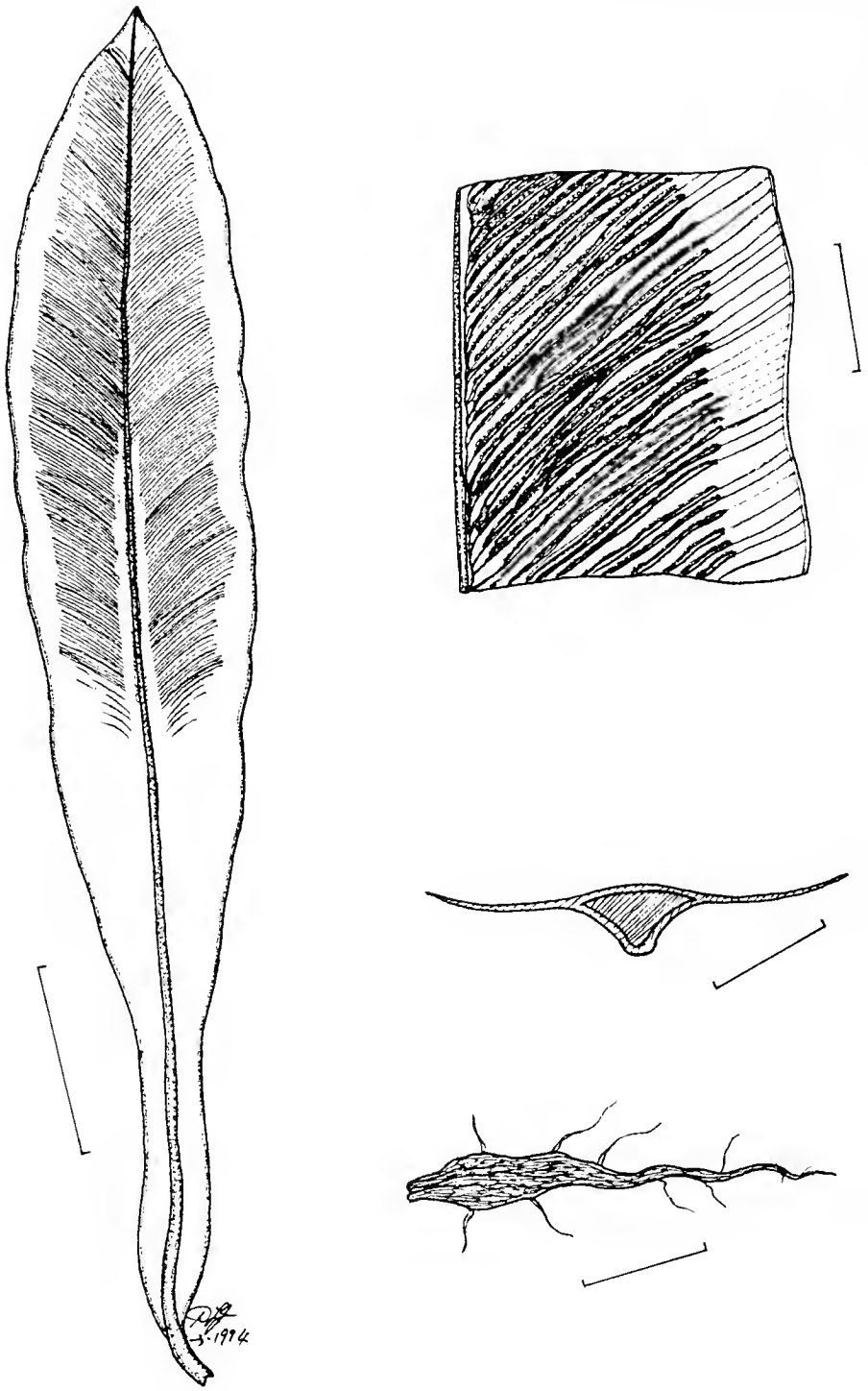

Fig. 1. *Asplenium goudeyi* D.L.Jones. a - abaxial view of leaf, scale-bar =1 cm. b - section of fertile frond, scale-bar = 2 cm. c - T.S. through frond near base, scale-bar = 1 cm. d - rhizome scale, scale-bar = 1 cm. All drawn from *Jones 5901* (CBG)

TYPE: cultivated at Australian National Botanic Gardens, Australian Capital Territory, Canberra, 22 Apr. 1990, *D.L. Jones 5901* (HOLOTYPE: CBG; ISOTYPE: AD, BRI, K, MEL, NSW, K). PROVENANCE: plant originally collected on the Goathouse Track, Mt Lidgbird, Lord Howe Island, 1985, *C.J. Goudey*.

Lithophytic or epiphytic fern with a very condensed spiral of steeply ascending fronds forming an erect, litter-collecting rosette. *Rhizome* erect, not branching, stout, woody, with a large mass of roots bearing copious, persistent, brown root hairs. *Scales* linear-lanceolate, c. 30 mm long, c. 2 mm wide, clothing apex of rhizome and base of stipes, thin-textured, clathrate, dark brown, margins with sparse, hair-like appendages. *Fronds* simple, more or less oblanceolate, 50-75 cm long, 12-18 cm wide, dull green with a glaucous bloom, coriaceous. *Stipes* short, stout, curved, greenish grey, somewhat shiny, adaxial surface nearly flat, hardly raised above the lamina, abaxial surface a broad, shallow vee, the ridge rounded. *Lamina* tapered to each end, margins entire or undulate, suddenly incurved in proximal quarter and forming a section c. 3 cm wide with nearly parallel margins before tapering into a short narrow wing which ends just above the stipe, apex obtusely apiculate. *Costa* of similar colour to stipe in proximal half to two thirds then becoming pale green, flat or shallowly raised adaxially, bluntly keeled abaxially. *Veins* forked once or twice near the costa or above the middle, a few of those on the basal section anastomosing, at an angle of c. 45° to costa, uniting to form a continuous vein c. 0.5 mm from margins. *Sori* narrow, linear, present on nearly every vein or vein branch in the distal half of a fertile frond, extending from near the costa for three-quarters of the distance to the margin. *Indusia* c. 0.3 mm wide, reflexed at maturity. *Spores* monolete, light brown, wing thickened or folded. (Fig. 1)

DISTRIBUTION

Endemic on Lord Howe Island where locally common.

HABITAT

Grows as an epiphyte on trees in closed forest and as a lithophyte on basalt rocks, boulders and cliff faces, sometimes in very exposed situations.

NOTES

Asplenium goudeyi has obvious affinities with *A. australasicum* but can be distinguished readily from this species by the much more leathery, dull green, thicker-textured fronds which have a glaucous appearance (yellow-green in *A. australasicum*). The fronds are much shorter than those of *A. australasicum*, (to 75 cm long compared with over 2 m long in *A. australasicum*), and arise at a steeper angle to the rhizome, so that the rosette is more erect than the widely radiating rosette of *A. australasicum*. In addition, the stipe and costa are grey-green (blackish in *A. australasicum*) and the obtuse ridge on the abaxial surface of the costa is in marked contrast to the strongly acute ridge of *A. australasicum*. These characteristics are retained in cultivation and sporelings of each species can be distinguished from an early age, the leaf colouration and the erect frond habit of *A. goudeyi* being distinctive. *Asplenium goudeyi* also has some similarities to *A. nidus* L. but that species has larger fronds (to 1.5 m long), the midrib on the adaxial surface is prominently raised and rounded (level with the lamina and flat in *A. goudeyi*) and the sori extend about halfway from the midrib to the lamina margin (about three-quarters the distance in *A. goudeyi*).

CONSERVATION STATUS

This species is common and conserved.

ETYMOLOGY

It gives me much pleasure to name this species after Christopher John Goudey, ardent fern enthusiast and nurseryman from Lara, Victoria. Mr Goudey introduced the species into cultivation and later recognised its distinctiveness.

SPECIMENS EXAMINED

LORD HOWE ISLAND: Smoking Tree Ridge, 22 Oct. 1978, *Telford 7063* (CANB); track to Mt Gower, 14 Mar. 1990, *Harman s.n. (D.L.Jones 5750)* (CANB); E. side of North Hummock, *Beauglehole 5589* (MEL).

Acknowledgements

I thank Chris Goudey for bringing this species to my attention and supplying living plants for study, Colin Harman for discussion about the species, Alex George for the Latin diagnosis and Bob Chinnock, Mark Clements, Lyn Craven and Jim Croft for commenting on the manuscript.

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Muelleria 9: 41–50 (1996)

Reinstatement of *Caladenia alpina* R.S.Rogers (Orchidaceae) as distinct from *Caladenia lyallii* Hook.f. and the description of *Caladenia cracens*, a related new species from southern Tasmania

David L. Jones

Centre for Plant Biodiversity Research, G.P.O. Box 1600, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT

Caladenia alpina R.S.Rogers, from mainland south-eastern Australia and Tasmania, is found to be distinct from *C. lyallii* Hook.f. which is endemic to New Zealand. Descriptions are provided for both of these species and a related species, *C. cracens*, from southern Tasmania is described as new. All species are illustrated and a key to the complex is provided.

Introduction

Caladenia lyallii Hook.f. was described in 1853 from material collected in Otago, New Zealand. A common Australian taxon which is widespread in subalpine regions, *C. alpina* R.S.Rogers, was described in 1927 from material collected in north-eastern Victoria (Mts Bogong, Hotham and the Baw Baws) and Mt Kosciusko in south-eastern New South Wales (Rogers 1927). *Caladenia alpina* was reduced to synonymy under *C. lyallii* by Rupp & Hatch (1945) and this decision has gained general acceptance (Firth 1965, Gray 1966, Rupp 1969, Nicholls 1969, Willis 1970, Burbidge & Gray 1970, Curtis 1979, Jones 1988, Clements 1989). Rupp and Hatch did not detail their methods of investigation nor did they provide evidence to support their conclusion which was that the two species were 'entirely identical except for such slight and unimportant variation as occurs in all plant species' (Rupp & Hatch 1945). This conclusion is investigated in the light of new observations on these orchids.

Methods

This study is based on the morphological examination of fresh flowers collected from localities in Australia, a comparison of living plants of all taxa cultivated in the collection of the Australian National Botanic Gardens, examination of dissected flowers mounted on cards, also dried and spirit-preserved herbarium specimens and photographs of living flowers of all of the taxa involved. Herbarium collections (spirit and dried) were examined from AD, AK, CANB, HO, MEL and WELT. Type specimens of *Caladenia alpina* and photographs of the type of *C. lyallii* (*fide* M.Clements) have been examined. Measurements given in descriptions are from living plants or dissected flowers on cards. Notes on distribution, habitat (particularly soil and plant association) and conservation status of the Australian species were derived from my own field studies; those of *C. lyallii* from discussion with Brian Molloy, references and herbarium labels.

Discussion

During field studies in mainland south-eastern Australia and Tasmania, the author became well acquainted with the habit and morphology of the common montane and subalpine orchid known in Australia as *Caladenia lyallii*. When an unidentified slender taxon was discovered in lowland areas of southern Tasmania, it became necessary to compare specimens of this species with *C. lyallii sensu stricto* and *C. alpina* (see

Methods section for details). This study showed that the species from southern Tasmania was undescribed. It also revealed morphological differences (obvious in fresh flowers) in the labellum and column between *C. lyallii* and *C. alpina*. Thus it became apparent to the author that *C. alpina* is distinct from *C. lyallii* and needs to be reinstated. Also *C. lyallii* is endemic to New Zealand. Because the identity of these latter two taxa has been confused, both are here provided with fuller descriptions. The slender species from lowland areas of southern Tasmania is described as new.

Characters that link all three taxa and distinguish them from superficially similar taxa such as *C. gracilis* R.Br. are:

an obovate dorsal sepal;

a broad distinctly trilobate labellum which is usually heavily barred with red;

the lamina calli in 2 to 6 irregular rows extending nearly to the apex of the labellum;

the calli in the proximal two-thirds prominently stalked, uniformly shaped and regularly arranged whereas those on the mid-lobe are sessile, very irregularly arranged and variously shaped.

Taxonomic treatment

KEY TO SPECIES OF THE *CALADENIA LYALLII* COMPLEX

1 Marginal calli on labellum mid-lobe sessile ..... **1. *Caladenia lyallii***
1: Marginal calli on labellum mid-lobe stalked 2

2 Leaf narrowly linear, 3 mm wide or less, scape single-flowered, lamina calli with small heads and very narrow stalks ..... **3. *Caladenia cracens***
2: Leaf linear-oblong to linear-lanceolate, 7 mm wide or more, scape 1-4-flowered, lamina calli with large heads and thick stalks ..... **2. *Caladenia alpina***

1. *Caladenia lyallii* Hook.f., *Fl. nov-zel.* 1:247 (1853). TYPE: on grassy hills, Otago, New Zealand, Dec. 1850, *Lyall s.n.* (HOLOTYPE: K photo, *fide* M.Clements; ISOTYPES: K, K-L microfiche).

Illustrations: Moore and Edgar, *Flora of New Zealand*, vol. 2, fig. 22 (1970); Mark & Adams, *New Zealand Alpine Plants*, plate 228 (1973); Johns and Molloy, *Native Orchids of New Zealand*, plate 10 (1983); St George, *Wild Orchids in the far South of New Zealand*, 18-19 (1992)

Tuberous, terrestrial herb growing singly or in loose groups. *Leaf* linear-lanceolate, 6-20 cm long, 1-6 mm wide, dark green, green or reddish at the base, hirsute with patent glandular and eglandular trichomes, 0.5-1 mm long. *Inflorescence* 5-25 cm tall, slender to moderately stout, green or reddish at the base, with patent glandular and eglandular trichomes as on the leaf. *Sterile bracts* ovate-lanceolate, 12-16 mm long, 5-7 mm wide, closely sheathing, externally hirsute with short, glandular hairs. *Fertile bracts* ovate-lanceolate, 9-17 mm long, 5-6 mm wide, closely sheathing, externally hirsute with short, glandular hairs. *Flowers* 1-2(-3), 2.2-2.8 cm across, white, pale yellow or pink inside, externally white or pale brownish-pink, sparsely glandular, with a sweet odour; dorsal sepal incurved and cucullate over the column and labellum, lateral sepals porrect or deflexed, divergent, petals spreading widely, curving forwards in distal half. *Dorsal sepal* broadly ovate-elliptical to obovate, 9-15 mm long, 4-6 mm wide, internally glabrous, externally hirsute with sessile and stalked glandular trichomes, apex obtuse. *Lateral sepals* asymmetrically lanceolate, 10-16 mm long, 4-6 mm wide, slightly falcate, internally glabrous, externally as for the dorsal sepal, apex acute to acuminate. *Petals* asymmetrically lanceolate, 9-15 mm long, 3-5 mm wide, falcate, internally glabrous, externally sparsely glandular, apex acuminate. *Labellum* hinged at the base, white, usually with prominent, narrow, red transverse bars, sometimes wholly white, apex white or pale yellow, distinctly trilobate. *Lamina* broadly oblong-elliptical in out-

line when flattened, 7-9 mm long, 5-7 mm wide, porrect or slightly erect in proximal quarter, then shallowly curved forwards, apex recurved; lateral lobes c. 2.5 mm wide, erect and column-embracing, anterior margins hardly rounded, slightly irregular, distal margins with several, irregular, short teeth; mid-lobe c. 3.2 mm long, narrowly deltate, margins yellow with 4-7 pairs of sessile, irregular marginal calli near the base (rarely one pair stalked) decrescent to the apex of the mid-lobe. *Lamina calli* in 2-4 (rarely 6) irregular rows, pale-yellow-headed, extending nearly to the apex of the mid-lobe; calli stalks becoming shorter towards labellum apex, those on the mid-lobe sessile; basal calli 2 or 4, c. 1.2 mm long, head irregularly ovoid, stalk c. 0.4 mm long, much narrower than the head; longest lamina calli c. 1.1 mm long, golf-stick-shaped, stalk c. 0.4 mm long, white. *Column* 7-8 mm long, c. 2 mm wide, slightly recurved near the base, curved forwards in distal third, whitish with irregular red, transverse bars, narrowly winged, central ridge c. 0.7 mm wide. Anther c. 1.6 mm long, c. 1.2 mm wide, white to pinkish, densely papillate, with a short rostrum. *Pollinia* 4, c. 1.3 mm long, roughly boomerang-shaped, cream, flat, mealy. *Stigma* c. 1 mm wide, irregularly circular, sunken, green. *Capsules* obovoid, 10-14 mm long, 3-4.5 mm wide, with glandular trichomes. (Fig. 1)

FLOWERING PERIOD
November to February.

DISTRIBUTION AND HABITAT
Endemic to New Zealand where widely distributed in the North and South Islands, Auckland Island and Stewart Island; extending from near sea-level in the south to montane and subalpine regions in the north. It grows in beech forests, subalpine herb-field, *Dracophyllum* bog, manuka scrub and tussock grassland.

NOTES
Caladenia lyalli has a generally more slender habit than *C. alpina* with a narrower leaf (1-6 mm wide) and 1 or 2 (rarely 3) generally smaller flowers (2.2-2.8 cm across). Many herbarium specimens of *C. lyallii* from WELT and AK are 8 cm tall or less and have leaves about 1 mm wide. By contrast even the smallest specimens of *C. lyallii* from Australian herbaria are much more robust than this and with a minimum leaf width of 7 mm. Florally *C. lyallii* can be distinguished from *C. alpina* by its squarer or more angular nearly oblong lateral lobes on the labellum, narrower sharply tapered labellum mid-lobe, sessile marginal calli and narrower (c. 2 mm wide), non-tapered column. *Caladenia lyallii* can be distinguished from *C. cracens* by its broader lamina calli on thicker stalks and sessile marginal calli on the labellum mid-lobe.

TYPIFICATION
This species will be lectotypified in a forthcoming publication (Molloy, Clements and Jones in prep.).

CONSERVATION STATUS
Widespread, common and conserved.

SELECTED SPECIMENS (67 examined):
NEW ZEALAND: Lake Manapouri, Jan. 1940, *Simpson* (AK); Mt Cook, 1898, *Adams* (AK); Mt Peel, above Cobb Valley, Nelson, 12 Jan. 1961, *Hynes* (AK); Nelson: Tinline, ATNB, 4 Nov. 1990, *Jenks* (CHR); Silver Peaks, Dunedin, Otago, 2 Dec. 1990, *St George* (CHR); Burnt Hill, Canterbury Plains, 14 Nov. 1990, *Molloy* (CHR); Taupo, 29 Nov. 1990, *Gibbs* (CHR); Mt Stalker, near Herbert, Otago, 9 Dec.1990, *St George* (CHR); Arthurs Pass, Canterbury, 4 Jan. 1991, *Molloy* (CHR); Sealey Range, 1890, *Suter* (WELT); Opepe, 14 Nov. 1978, *Oliver* (WELT); Pelukit Bay, 25 Nov. 1892, *Kirk* (WELT); Kirwan Hill, near Reefton, 23 Nov. 1950, *Ardley* (WELT).

2. *Caladenia alpina* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 51: 12 (1927). SYNTYPES: Victoria: Mount Hotham and Mount Bogong, Dec. 1921, Jan. 1924, *A.J. Tadgell*; Baw Baws, 3 Jan. 1925, *W.H. Nicholls*; New South Wales: Mount Kosciusko, Jan. 1924, *G.V. Scammell* (AD).

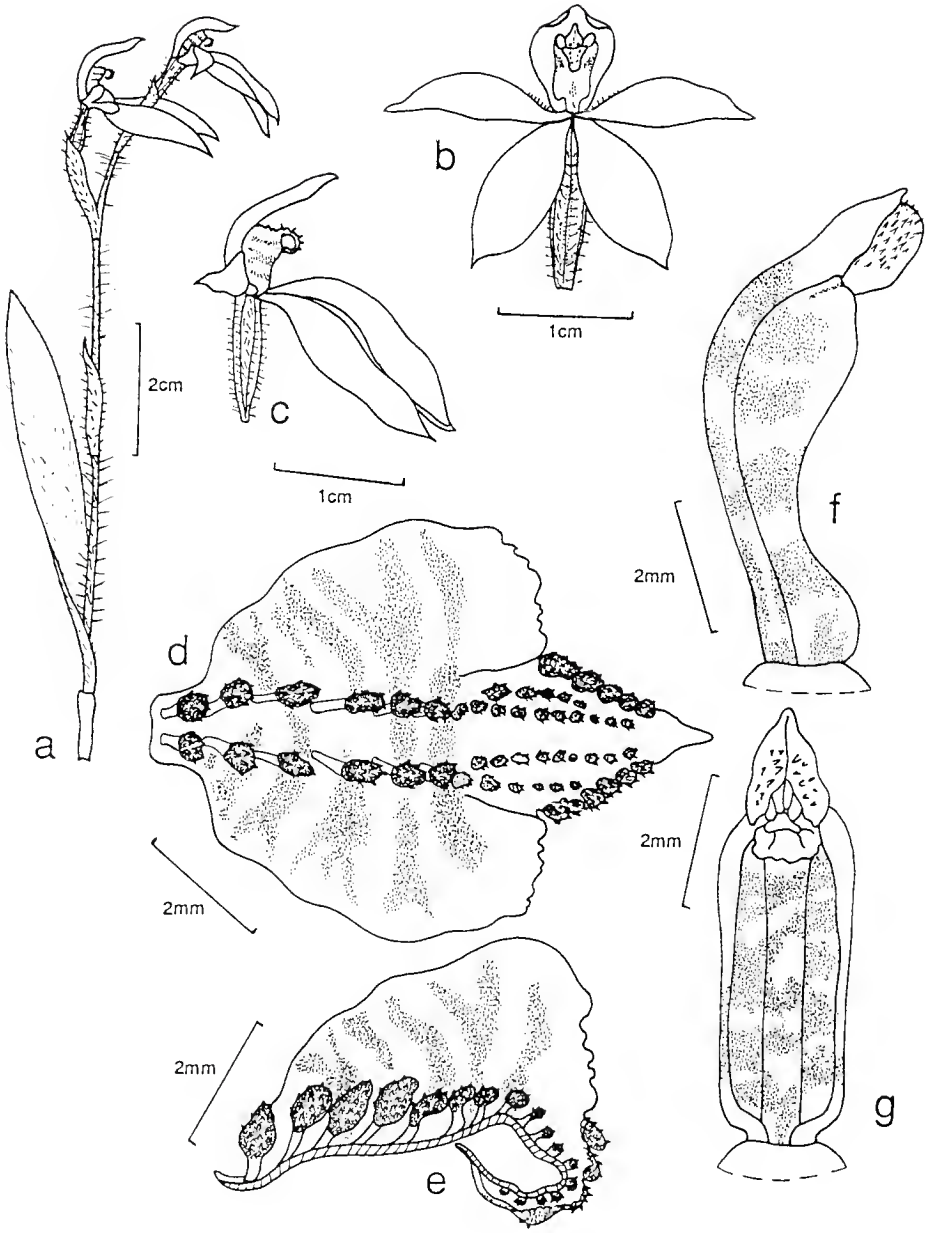

Fig. 1. *Caladenia lyallii* Hook.f. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - longitudinal section of labellum. f - column from side. g - column from front. All drawn from *Molloy* (CBG).

Illustrations: (all as *C. lyallii*) W.H. Nicholls, *Orchids of Australia*, complete ed., plate 226 (1969); C.E. Gray, *Victorian Native Orchids*, vol. 1, 12 (1966); E.R. Rotherham *et al.*, *Flowers & Plants of New south Wales & Southern Queensland*, plate 363 (1975); A.B.Costin *et al.*, Kosciusko Alpine Flora, plate 144 (1979); P. Bernhardt, In Hardin, *Flora of New South Wales* vol. 4, 205 (1993); T.J. Entwisle, In Walsh and Entwisle, *Flora of Victoria* vol. 2, fig. 152j-k (1994).

Tuberous terrestrial herb growing singly or in loose groups. *Leaf* linear-oblong to linear-lanceolate, erect, 12-22 cm long, 7-15 mm wide, dark green, red at the base, densely hirsute with patent glandular and eglandular trichomes 05-1 mm long. *Inflorescence* 15-30 cm tall, stout, reddish at the base, with patent glandular and eglandular trichomes as on the leaf. *Sterile bracts* ovate-lanceolate, 18-40 mm long, 8-12 mm wide, closely sheathing to spreading, externally hirsute with short, glandular hairs. *Fertile bracts* ovate-lanceolate, 5-15 mm long, 6-8 mm wide, closely sheathing, externally hirsute with short, glandular hairs. *Flowers* 1-4, 3-3.5 cm across, white inside, externally pinkish or sometimes dark red, sparsely to densely glandular, with a faint musky odour; dorsal sepal incurved and broadly cucullate over the column and labellum, lateral sepals porrect or slightly erect, parallel or slightly divergent, petals spreading widely, curving forwards in distal half. *Dorsal sepal* broadly obovate, 9-13 mm long, 5-8 mm wide, internally glabrous, externally hirsute with sessile and stalked glandular trichomes, apex obtuse to slightly apiculate. *Lateral sepals* asymmetrically oblanceolate, 9-15 mm long, 4-6 mm wide, slightly falcate, internally glabrous, externally as for the dorsal sepal, apex subacute. *Petals* asymmetrically lanceolate, 9-13 mm long, 3-5 mm wide, falcate, internally glabrous, externally sparsely glandular, apex acuminate. *Labellum* hinged at the base, white with prominent, narrow, red transverse bars, apex yellow, distinctly trilobate. *Lamina* broadly ovate-elliptical in outline when flattened, 5-8 mm long, 4-6.5 mm wide, erect in proximal third then curved forwards, apex recurved; lateral lobes c. 2.3 mm wide, erect and column-embracing, anterior margins rounded, slightly irregular, distal margins with 1-4 short, linear, somewhat irregular calli; mid-lobe c. 2.6 mm long, deltate, margins yellow, apex recurved with c. 3-5 pairs of stalked, linear, marginal calli near the base, decrescent, sessile and irregular to the apex of the mid-lobe. *Lamina calli* in 4-6 irregular rows, yellow-headed, extending nearly to the apex of the mid-lobe; calli stalks becoming shorter towards labellum apex, those on mid-lobe sessile; basal calli 4, c. 1.3 mm long, head irregularly ovoid, stalk c. 0.4 mm long, much narrower than head; longest lamina calli c. 1.2 mm long, golf-stick-shaped, stalk c. 0.5 mm long, white. *Column* 7-8 mm long, c. 2.8 mm wide, slightly recurved near the base, curved forwards in distal third, whitish with irregular, red transverse bars, narrowly winged, central ridge c. 1.5 mm wide. *Anther* c. 2 mm long, c. 1.6 mm wide, white to pink, densely papillate with a prominent rostrum. *Pollinia* 4, c. 1.2 mm long, roughly boomerang-shaped, cream, flat, mealy. *Stigma* c. 1.5 mm wide, more or less circular, sunken, green. *Capsules* ovoid to obovoid, 15-17 mm long, 6-7 mm wide, glandular. (Fig. 2)

FLOWERING PERIOD

November to February.

DISTRIBUTION AND HABITAT

South-eastern Australia, south from the Brindabella Ranges (A.C.T.) and Snowy Mountains in south-eastern New South Wales, eastern Victoria, south-western Victoria (isolated, disjunct western occurrences on high peaks in the Grampians) and Tasmania. It grows in higher montane and subalpine zones, particularly in snowgum woodland but also in subalpine herbfield and on the margins of small streams and bogs.

TYPIFICATION

Clements (1989) chose the following specimen in AD as a lectotype: Mt Feathertop, Dec. 1921, *A. J. Tadgell in herb. R. Rogers 2106*. This collection was not listed in the protologue by Rogers and a new lectotype is chosen here. Victoria. Mount Hotham and Mount Bogong, Dec. 1921, Jan. 1924, *A.J. Tadgell* (LECTOTYPE: **here chosen**, AD).

NOTES

Caladenia alpina has been included with *C. lyallii* since the treatment by Rupp and Hatch (1945). *Caladenia alpina* has a generally more robust habit than *C. lyallii* with broader leaves (7-15 mm wide) and 1-4 larger flowers (3-3.5 cm across). Florally *Caladenia alpina* can be distinguished from *C. lyallii* by its distinctly rounded lateral lobes on the labellum, broader less-tapered labellum mid-lobe, prominently stalked marginal calli on the mid-lobe and broader (c. 2.8 mm wide) distinctly tapered column. *Caladenia cracens* is much less robust than *C. alpina* and has leaves less than 3 mm wide, a single-flowered scape and lamina calli with small heads and very narrow stalks.

Specimens of *C. alpina* from mountain peaks in southern Tasmania commonly have a dense vestiture of dark red glands on the exterior of the perianth segments, but are otherwise similar to plants from northern Tasmania and mainland south-eastern Australia.

CONSERVATION STATUS

Widespread, locally common and well conserved in National Parks and reserves.

SELECTED COLLECTIONS (81 examined)

AUSTRALIAN CAPITAL TERRITORY: Mt Ginini, 30 Nov. 1990, *Jones 7247* (CBG); junction of Moonlight Hollow and Bendora Dam Roads, 24 Nov. 1991, *Jones 8558* (CBG).

NEW SOUTH WALES: northern slopes of Mt Clarke, Kosciusko National Park, summer 1957, *Costin* (NSW, CANB); near Cabramurra, 20 Dec. 1960, *Moore 3200* (CANB).

VICTORIA: summit of Mt Stirling, 18 Nov. 1961, *Filson 3993* (MEL); Mt Rosea, Grampians, Nov. 1931, *Nicholls* (MEL); Razorback, Mt Feathertop, Dec. 1921, *Tadgell* (MEL).

TASMANIA: Meetus Falls, Eastern Tiers, 22 Nov. 1986, *Collier* 1933 (HO); near Mt Arrowsmith, 2 Dec. 1989, *Collier 4468* (HO); Mt St John, 13 Dec. 1988, *Collier 3784* (HO); Ben Lomond, 28 Dec. 1978, *Noble 28043* (HO); White Rock, Mt Wellington, Dec. 1929, *Rodway* (HO); Franklin River, 15 Dec. 1986, *Collier 1874* (HO).

3. *Caladenia cracens* D.L.Jones *sp. nov.*

affinis *Caladenia alpinae* R.S.Rogers a qua foliis minoribus angustioribus, scapis tenuioribus, floribus solitaris minoribus roseis usque rubris et segmentis glandulosus valde et callis laminae pertenuioribus et columna solida relative lata differt.

TYPE: Tasmania, Lenah Valley, near Hobart, 29 Oct. 1990, *D. L. Jones 6833 & C. H. Broers* (HOLOTYPE: CBG; ISOTYPES: CBG, HO, MEL, NSW).

Tuberous terrestrial herb growing singly or in loose groups. *Leaf* narrowly linear, 5-12 cm long, 1-3 mm wide, dark green, purplish-red at the base, sparsely hirsute with patent, eglandular trichomes c. 2 mm long. *Inflorescence* 8-15 cm tall, slender, wiry, dark purplish-red at the base, sparsely hirsute with patent glandular and eglandular trichomes. *Sterile bracts* narrowly obovate, 12-16 mm long, 2-3 mm wide, closely sheathing, externally hirsute with short, glandular hairs. *Fertile bracts* elliptical-obovate, 7-11 mm long, 3-4.5 mm wide, closely sheathing, externally hirsute with short, glandular hairs. *Flower* solitary, 2-2.5 cm across, pale pink to dark pink, densely glandular, with a sweet odour; dorsal sepal incurved and cucullate over the column and labellum, lateral sepals porrect, divergent, petals spreading widely, curving forwards in distal half. *Dorsal* sepal obovate-spathulate, 8-12 mm long, 3-6 mm wide, internally glabrous, externally densely glandular with sessile, ovoid, red trichomes, apex broadly obtuse. *Lateral sepals* asymmetrically oblanceolate, 8-13 mm long, 3-5 mm wide, slightly falcate, internally glabrous, externally as for the dorsal sepal, apex subacute to obtuse. *Petals* asymmetrically lanceolate, 8-12 mm long, 3-5 mm wide, falcate, internally glabrous, externally as for the dorsal sepal, apex acuminate. *Labellum* hinged at the base, heavily suffused and barred with red, apex with cream margins, distinctly trilobate. *Lamina* broadly ovate-elliptical in outline when flattened, 7-8 mm long, 4.5-6 mm wide, erect in proximal third, then shallowly curved forwards, apex recurved; lateral lobes c. 2.2 mm wide, erect and column-embracing, anterior margins rounded, distal margins irregular, with 1 or 2 pairs of linear, stalked calli towards the sinus with the mid-lobe; mid-lobe c.

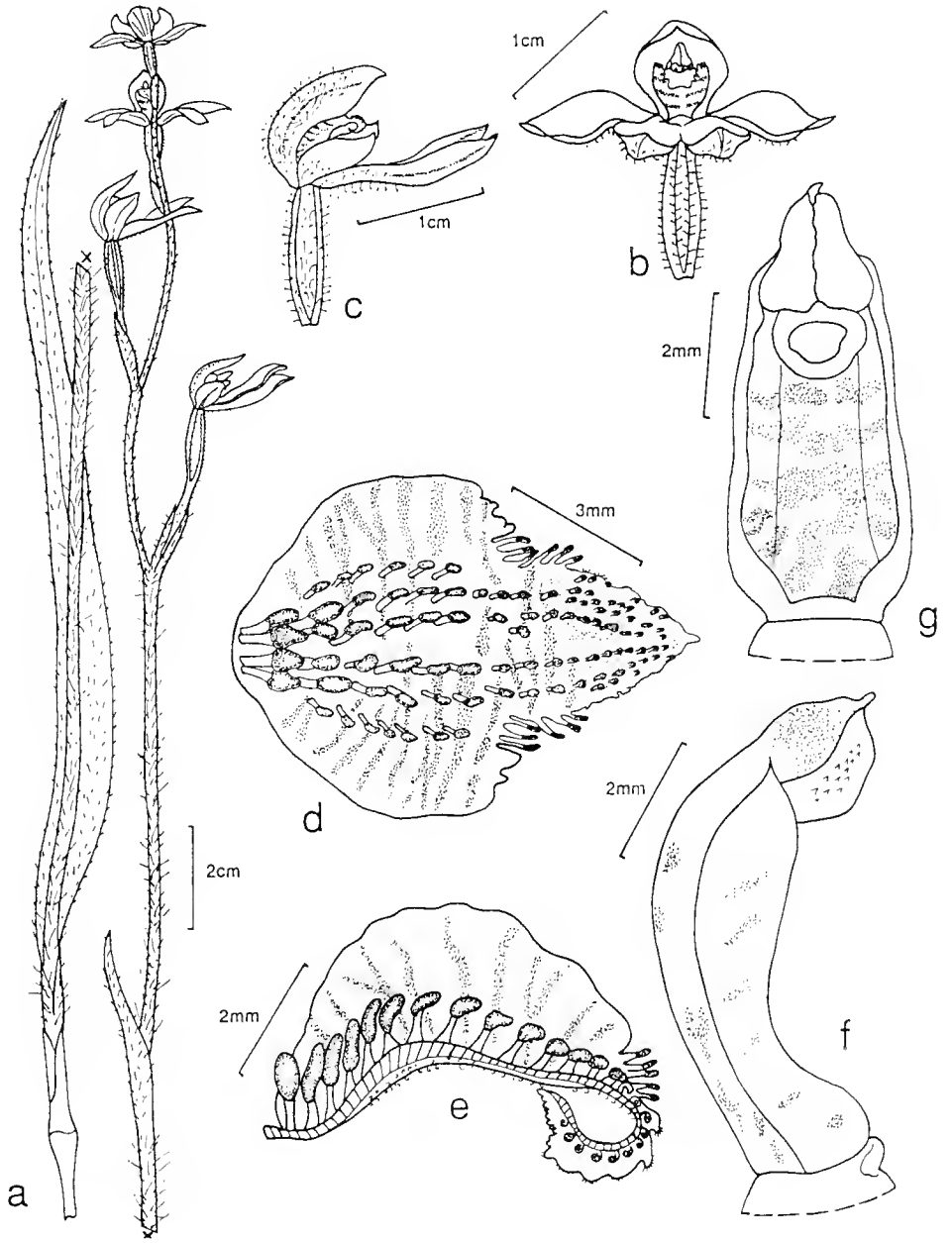

Fig. 2. *Caladenia alpina* R.S.Rogers. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - longitudinal section of labellum. f - column from side. g - column from front. All drawn from *Jones 7247* (CBG).

2.7 mm long, broadly deltate, margins cream, with 5-8 pairs of linear marginal calli, decrescent to the apex of the mid-lobe. *Lamina* calli in 2-4 irregular rows, very slender, cream or yellow-headed, extending nearly to the apex of the mid-lobe; calli stalks becoming shorter towards the labellum apex, those on the mid-lobe sessile; basal calli 2, c. 0.9 mm long, head irregularly ovoid, stalk c. 0.4 mm long, much narrower than head; longest lamina calli c. 1 mm long, clavoid, stalk 0.6 mm long, white. *Column* 6-6.5 mm long, c. 2.5 mm wide, recurved near the base, curved forwards in distal third, green to whitish with red suffusions and irregular red transverse bars, narrowly winged, central ridge c. 1.2 mm wide. *Anther* c. 1.8 mm long, c. 1.2 mm wide, cream to pinkish, papillate, with a short rostrum. *Pollinia* 4, c. 1.2 mm long, roughly boomerang-shaped, cream, flat, mealy. *Stigma* c. 1.3 mm wide, irregularly circular, sunken, green. *Capsules* obovoid, 10-12 mm long, 4-5 mm wide, with glandular trichomes. (Fig. 3)

FLOWERING PERIOD
October and November.

ETYMOLOGY
Derived from the Latin, *cracens*, neat, graceful, thin, all of which apply to this elegant species.

DISTRIBUTION AND HABITAT
Endemic to southern Tasmania where distributed from near sea level to the foothills at low altitudes. It grows in open forest which has a sparse to densely shrubby understorey, less commonly in heath. Soils are clay loams, skeletal loams developed on mudstone and sandy loam.

NOTES
Caladenia cracens has gone unrecognised within the *C. lyallii* complex. It can be distinguished from *C. lyallii* by the stalked marginal glands on the labellum mid-lobe and smaller lamina calli on narrower stalks. From *C. alpina* it differs by its much more slender habit, narrower leaves (1-3 mm wide) and generally smaller (2-2.5 cm across), pink to reddish flowers with heavily glandular segments, much thinner lamina calli and a short, relatively broad (2.5 mm wide) column. *Caladenia cracens* occupies different habitats, grows at lower altitudes and flowers earlier than *C. alpina* in Tasmania.

CONSERVATION STATUS
Relatively widespread, common and conserved.

SELECTED COLLECTIONS (23 examined)
TASMANIA: Mountain Park Reserve, near Hobart, 29 Oct. 1990, *Jones 6796 & Broers* (CBG); south of Ferntree, 29 Oct. 1990, *Jones 6844 & Broers* (CBG); Lighthouse Rd, Bruny Island, 22 Oct. 1993, *Wapstra (Jones 12521)* (CBG); Huon Rd, Ferntree, 24 Oct. 1993, *Wapstra (Jones 12525)* (CBG); Little Lagoon Beach, Southport, 1 Dec. 1986, *Collier 1781* (HO); Huon Highway, Hobart, 2 Dec. 1986, *Collier 1805* (HO); Safety Cove, south of Port Arthur, 5 Dec. 1986, *Collier 1706* (HO); Longley, 13 Oct. 1984, *Moscal 8626* (HO); Badgers Range, Sheffield, 30 Oct. 1988, *Collier 3697* (HO); Snug, Oct. 1928, *Giblin 932* (HO); Blackmans Bay, Oct. 1927, *Rodway* (HO).

Acknowledgements
I thank Brian Molloy, Landcare Research, New Zealand for useful discussions and supplying material of *Caladenia lyallii*. Les Rubenach, Hans and Annie Wapstra, Mark Wapstra, Ross Smith, Ron Williamson, Peter Branwhite, Everett Foster and David Ziegeler are thanked for supplying specimens. I also thank the Directors of the Australian Orchid Foundation for their support of field operatives and thank the directors of the herbaria AD, CANB, CHR, HO, MEL for allowing me access to specimens. Mark Clements and Chris Puttock are thanked for commenting on the manuscript and Alex George for preparing the Latin diagnosis. Corinna Broers and Barbara Jones

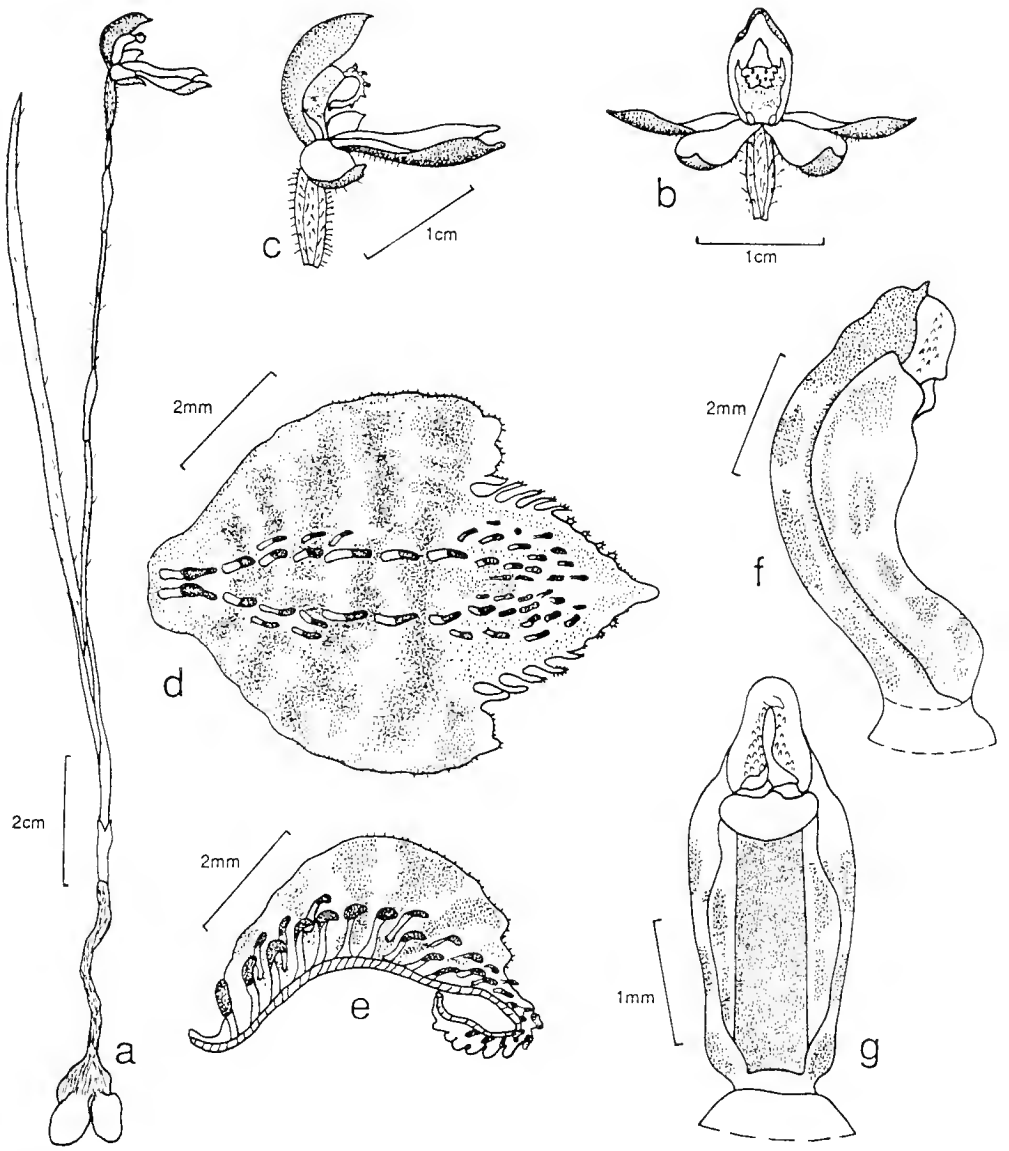

Fig. 3. *Caladenia cracens* D.L.Jones. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - longitudinal section of labellum. f - column from side. g - column from front. All drawn from *Ziegeler* (CBG).

provided valuable technical assistance throughout the project. Marion Garratt prepared the illustrations from my sketches.

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Resolution of the *Prasophyllum alpinum* R.Br. (Orchidaceae) complex in mainland south-eastern Australia, Tasmania and New Zealand

David L. Jones

Centre for Plant Biodiversity Researeh, G.P.O. Box 1600, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT

An aeeount is presented of the *Prasophyllum alpinum* eomplex in subalpine regions of south-eastern Australia, Tasmania and New Zealand. Four speeies are reeognised; *Prasophyllum sphacelatum* is deseribed as new, *P. tadgellianum*, found to be the eommon speeies from south-eastern Australia, is reinstated from synonymy, *P. alpinum sensu stricto*, is a narrow endemie restrieted to eentral and southern Tasmania and *P. colensoi* is endemie to New Zealand. All speeies are illustrated and a key to the eomplex is provided.

Introduction

The moist, grassy woodlands and herbfields of subalpine areas in mainland south-eastern Australia, Tasmania and New Zealand provide suitable growing eonditions for speeies of *Prasophyllum*. Two groups are prominent, the speeies of one group having a eonspieuous white labellum with an ineonspieuous eallus (represented by *P. suttonii* R.S.Rogers & B.Rees), those of the other group having flowers whieh are dull greenish or brownish and have a prominent, raised labellum eallus. For the latter group the name *Prasophyllum alpinum* R.Br. has been eommonly interpreted as applieable to all speeimens/entities in south-eastern Australia and Tasmania (Rupp 1943, Firth 1965, Gray 1966, Nieholls 1969, Burbidge & Gray 1970, Willis 1970, Clements 1989, Curtis 1979, Jones 1988, Bernhardt & Rowe 1993), with *P. tadgellianum* R.S.Rogers being treated as its synonym. Bates (1994) noted that mainland populations differed from *P. alpinum* in being outerossing and having larger flowers and 'if these are eonsidered distinet at speeies level, the name *P. tadgellianum* applies to them'. *Prasophyllum colensoi* J.D.Hook. from similar subalpine areas in New Zealand (Moore & Edgar 1970, Johns & Molloy 1983) has long been reeognised as a New Zealand eounterpart of *P. alpinum*.

Field eolleetions over several years by the author in subalpine regions of south-eastern New South Wales and north-eastern Vietoria have established the existenee of two separate taxa in mainland Australia. Examination of photographs of the types of *P. alpinum* (*fide* M. Clements) and *P. colensoi* (*fide* B. Molloy), has elearly shown that neither of these taxa is present on the Australian mainland. Disseetion of fresh material from Mount Wellington, Tasmania (the type loeality of *P. alpinum)* and of spirit materi-al of *P. colensoi* from New Zealand has eonfirmed these findings. Examination of the type speeimens of *P. tadgellianum* shows it to be the widespread mainland taxon. Aeeordingly the *Prasophyllum alpinum* eomplex eonsists of four taxa, viz. *P. alpinum* (here reinterpreted *sensu stricto*), *P. tadgellianum* (here reinstated), *P. colensoi* and *P. sphacelatum,* here deseribed as new.

Methods

This study is based on the morphologieal examination of fresh flowers eolleeted from loealities in south-eastern mainland Australia and Tasmania and field observations and herbarium eolleetions (spirit and dried) from the following herbaria (AD, CHR, CANB, HO and MEL.). Type speeimens or photographs of types of all pertinent deseribed taxa have been examined ineluding those in overseas herbaria (BM, K, K-L). Measurements

given in descriptions are from living plants or spirit-preserved specimens. Notes on distribution, habitat (particularly soil and plant associations) and conservation status of the Australian species were derived from my own field studies; those of *P. colensoi* from discussion with Brian Molloy, references and herbarium labels.

Taxonomic history

The first species recognised within the complex was *P. alpinum* described by Brown in 1810. Brown's specimens were collected from the top of Table Mountain (now Mount Wellington), Hobart, Tasmania (Brown 1810, Clements 1989). *Prasophyllum colensoi* was described by Hooker in 1853 from material collected in New Zealand. The next taxon to be described was *P. frenclii* var. *tadgellianum* by Rogers in 1922 from specimens collected on Mount Hotham in north-eastern Victoria at an altitude of 5,100 ft. He redescribed this taxon at specific rank about one year later based on specimens collected on Mount Bogong, north-eastern Victoria at an altitude of 6,500 ft. Almost from the time of its description, this latter taxon has been treated as a synonym of *P. alpinum* (Nicholls 1934, Rupp 1943), although some authors have regarded *P. tadgellianum* as a valid species (Pescott 1928, Ewart 1930).

Taxonomic treatment

KEY TO SPECIES OF THE *PRASOPHYLLUM ALPINUM* COMPLEX

1 Flowers 5.5-7 mm long, labellum ovate, erect in distal quarter, column wings about half as long as the anther ..... **1. *Prasophyllum alpinum***
1: Flowers 10 mm or more long, labellum ovate-lanceolate, erect in distal half, column wings as long as or longer than the anther 2

2 Flowers 14-18 mm long ..... **4. *Prasophyllum sphacelatum***
2: Flowers 10-12 mm long 3

3 Labellum conspicuously stalked at the base, lateral sepals free throughout or connate at the very base ..... **2. *Prasophyllum colensoi***
3: Labellum shortly stalked or subsessile at the base, lateral sepals connate except at the tip ..... **3. *Prasophyllum tadgellianum***

1. *Prasophyllum alpinum* R.Br., *Prodr.* 318 (1810). *P. fuscum* R.Br. var. *alpinum* (R. Br.) C.Moore & Betche, *Handb. Fl. NSW* 396 (1893). TYPE: Top of Table Mountain near Derwent River, Tasmania, *R. Brown s.n.* (LECTOTYPE: BM photo; *fide* M.Clements 1989).

Solitary terrestrial tuberous herb 6-20 cm tall. *Tubers* not seen. *Leaf* 8-20 cm long, 2-5 mm across at the widest, dark green, base white, free lamina 8-12 cm long, erect, slender, moderately stiff, longer than inflorescence. *Raceme* 3-10 cm long, bearing 5-14 subsessile, well-spaced flowers. *Floral bracts* ovate, c. 1.6 mm long, c. 2 mm wide, closely sheathing, subacute to obtuse or emarginate. *Ovary* obpyriform to obovoid, c. 5 mm long, c. 2.5 mm wide, set at about 35° to the rachis. *Flowers* 5.5-7.5 mm long, green to greenish brown, no scent apparent, some flowers opening freely, often others remaining closed. *Dorsal sepal* ovate to elliptical, 4-5 mm long, 2-2.2 mm wide, decurved, subacute to obtuse, distal margins involute. *Lateral sepals* connate, straight or slightly recurved in distal half, involute near the apex. *Petals* linear-lanceolate, 3.5-4 mm long, c. 1 mm wide, obliquely erect, often overlapped by the margins of the lateral sepals. *Labellum* more or less ovate to broadly ovate-lanceolate in outline when flattened, 3-4 mm long, 2-2.3 mm wide, distinctly clawed, whitish to greenish, proximal third erect, the margins entire to slightly folded; callus occupying about two-thirds of the ventral surface of the lamina and of similar shape, raised, very thick, green, shiny, smooth, extending nearly to the labellum apex. *Column* porrect from the end of the ovary, c. 2 mm long, c. 1.5 mm wide; appendages narrowly linear, much shorter than the

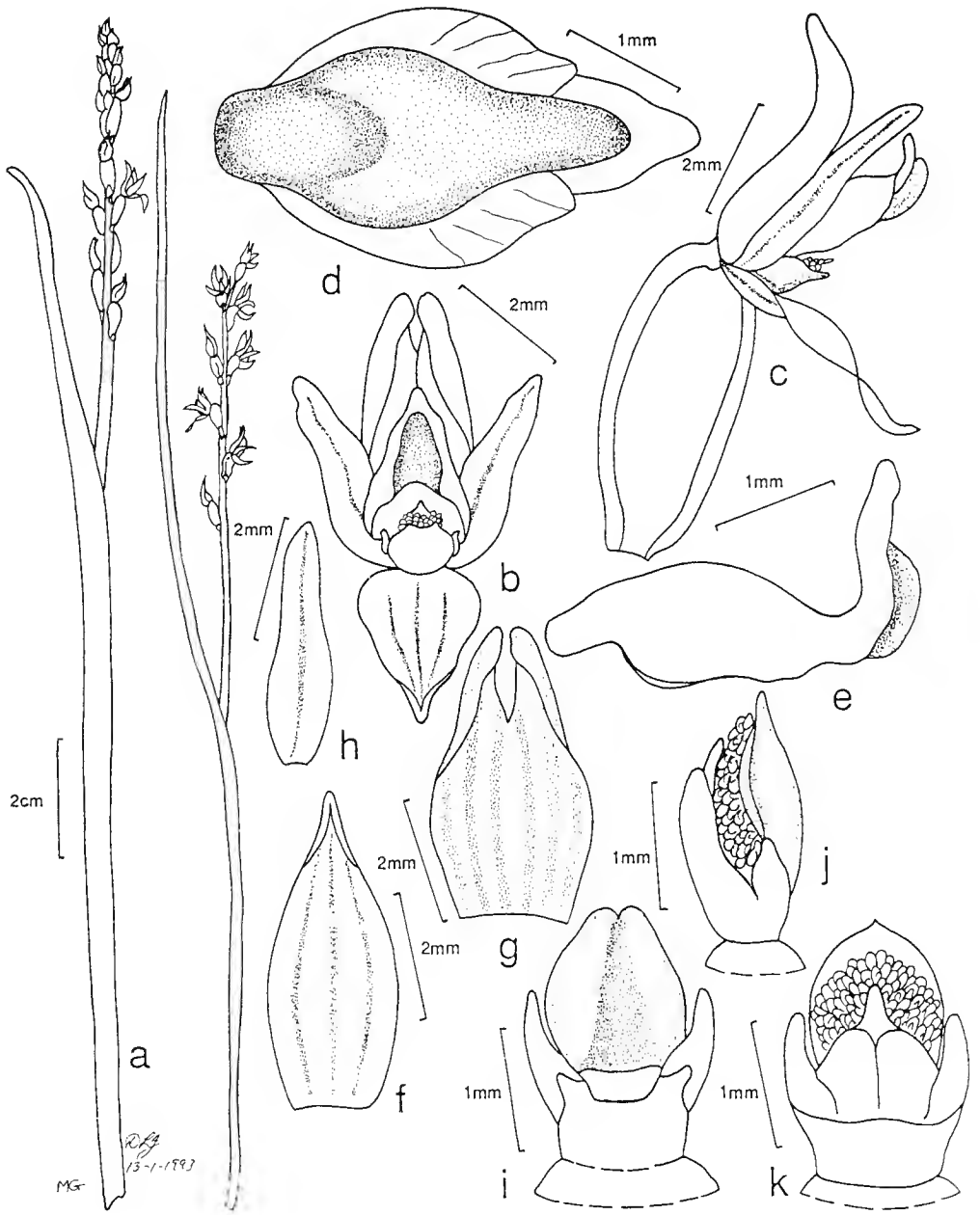

Fig. 1. *Prasophyllum alpinum* R.Br. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - labellum from side. f - dorsal sepal flattened out. g - conjoined lateral sepals. h - petal. i - column from rear. j - column from side. k - column from front. All drawn from *H. Wapstra* (*Jones 11177*, CBG).

anther, obtuse, c. 1.4 mm long, 0.3 mm wide, with connate basal lobes c. 0.4 mm long. *Anther* ovate, c. 1.3 mm long, 1.1 mm wide, green to greenish brown, smooth to rugulose; rostrum short, obtuse. *Pollinarium* c. 1 mm long, degenerate; viscidium absent or vestigial; hamulus absent or vestigial; pollinia c. 1 mm long, pale yellow, sectile. *Stigma* reniform, c. 1 mm long, c. 0.7 mm wide, the rostellum about as high as the appendages. *Capsules* obovoid, c. 6 mm long, 3 mm wide, green, shiny. (Fig. 1)

FLOWERING PERIOD
December to February.

DISTRIBUTION AND HABITAT
Endemic to Tasmania where common on southern peaks above 650 m. altitude, extending north to about Cradle Mountain. Grows in subalpine herbfield, sedgeland and in moist grassy areas among *Eucalyptus coccifera* J.D.Hook.; occasionally in feldmark. Sometimes plants are found growing in the cushions of *Abrotanella forsterioides* (J.D.Hook.) Benth.

NOTES
Prasophyllum alpinum is a very distinctive species which can be distinguished from all other species in the complex by its small (5.5-7.5 mm long), green to greenish brown, apparently scentless flowers. In addition the labellum is ovate rather than ovate-lanceolate as in the other subalpine taxa, with the distal third erect (distal half in other taxa). The column is very distinctive, being dominated by the anther and with very short column wings. The flowers of this species generally open freely but in some localities cleistogamous variants occur, these plants having excessively swollen ovaries at anthesis. Occasional plants may also have racemes of cleistogamous flowers mixed with open flowers.

CONSERVATION STATUS
Widely distributed, locally common and conserved in National Parks.

SELECTED SPECIMENS (24 examined)
TASMANIA: south ridge of Dome Hill, Eldon Range, 6 Feb. 1987, *Buchanan* (HO); slopes of Mt Wellington, no date, *Chisholm, Herb. W.H.Nicholls* (MEL); track to Lake Beleher, Mt Field National Park, 2 Feb. 1969, *Canning 2294* (CBG); Mt Barrow, 13 Feb. 1969, *Canning 2646* (CBG); Ben Nevis, 18 Feb. 1986, *Collier 1294* (HO); Mt Sedgewick, 27 Dec. 1987, *Collier 3055* (HO); Collinsvale Track, Mt Wellington, 7 Feb. 1947, *Curtis* (HO); Lake Thor, Walls of Jerusalem, 21 Jan. 1983, *Moscal 1457* (HO); Cradle Mtn, no date, *Sutton, Herb W.H.Nicholls* (MEL).

2. *Prasophyllum colensoi* J.D.Hook., *Fl. N.Z.* 1:241-2 (1853). TYPE: Northern and Middle Islands, common. East coast and interior, *W. Colenso*; Canterbury, *D. Lyall.* (SYNTYPES: K, photo; *fide* M. Clements).

Prasophyllum pauciflorum Colenso, *Trans. & Proc. New Zealand Inst.* 18: 273 (1886). TYPE: Hills, country west of Napier; 1883, *W. Colenso* (HOLOTYPE: not found) - *P. colensoi* is common in this locality (B. Molloy *pers. comm.*).

Illustrations: T.F. Cheeseman (ed.), *Illustrations of the New Zealand Flora, vol. 2,* fig. 193 (1914); J.T. Salmon, *New Zealand Flowers and Plants in Colour,* plate 479 (1963); L.B. Moore and E. Edgar, *Flora of New Zealand,* vol. 2, fig. 30 (1970); L.B. Moore & J.B. Irwin, *The Oxford Book of New Zealand Plants* 194, fig. 2 (1978); J. Johns and B. Molloy, *Native Orchids of New Zealand*, plate 78 (1983).

Solitary terrestrial tuberous herb 10-30 cm tall. *Tubers* not seen. *Leaf* 12-35 cm long, 2-5 mm across at the widest, dark green, base white, free lamina 8-12 cm long, erect, slender, moderately stiff, longer than inflorescence, often partially withered at anthesis. *Raceme* 3-12 cm long, bearing 5-20 (rarely more), subsessile, moderately crowded flowers. *Floral bracts* ovate c. 1.6 mm long, c. 2 mm wide, closely sheathing, subacute

to obtuse or emarginate. *Ovary* obpyriform to obovoid, c. 4 mm long, 2.3 mm wide, set at about 40° to the rachis. *Flowers* 10-11 mm long, yellowish-green to reddish-brown, lightly scented, opening freely. *Dorsal sepal* ovate to elliptic-ovate, 6-7 mm long, 2-2.4 mm wide, decurved, obtuse to apiculate, distal margins involute. *Lateral sepals* linear-lanceolate, 6-7 mm long, 1.7-2 mm wide, free or connate at the base, recurved in distal half, parallel to slightly divergent, involute near the apex, bidentate. *Petals* oblong-lanceolate to linear-lanceolate, 6-7 mm long, c. 1.5 mm wide, porrect, decurved. *Labellum* ovate-lanceolate in outline when flattened, 6-7.5 mm long, 4-4.5 mm wide, conspicuously stalked, greenish to reddish-brown, proximal half erect or recurved, the tip often protruding between the lateral sepals, the margins entire or slightly undulate; callus occupying about two-thirds of the ventral surface of the lamina and of similar shape, raised, very thick and fleshy, green to red, shiny, wrinkled near the apex, extending nearly to the labellum apex. *Column* porrect from the end of the ovary, c. 2 mm long, c. 2 mm wide; appendages narrowly linear, falcate, longer than the anther, obtuse, c. 1.5 mm long, 0.4 mm wide, with connate basal lobes c. 0.4 mm long. *Anther* ovate, c. 1.5 mm long, 1.3 mm wide, brown, smooth to rugulose, much shorter than the rostellum; rostrum short, obtuse. *Pollinarium* c. 1 mm long; viscidium c. 0.2 mm long, ovate, white; hamulus c. 0.3 mm long, ligulate; pollinia c. 0.9 mm long, linear-clavoid, yellow, sectile. *Stigma* reniform, c. 1.3 mm x 1 mm, the rostellum about as high as the appendages. *Capsule* obovoid, c. 6 mm long, 3 mm wide, green to red-brown, shiny. (Fig. 2)

FLOWERING PERIOD
November to January

DISTRIBUTION AND HABITAT
Endemic to New Zealand where widely distributed over the North and the South Island; in the North Island mainly occurring in mountainous regions south of the Central Volcanic Plateau, but distributed sporadically as far north as Towai (Moore & Edgar 1970); in the South Island occurring from sea level to about 1200 m. altitude. Grows in subalpine herbfield in tussock grassland and in moist areas around the margins of bogs.

NOTES
Prasophyllum colensoi sensu stricto is similar morphologically to *P. tadgellianum* but can be distinguished by the more slender leaf, broader, lanceolate petals, the conspicuously stalked labellum, the lateral sepals being free throughout or connate only at the very base and the much more angular stigmatic plate which is longer than the anther. Bates (*pers. comm.*) maintains that detailed research into the great variation exhibited by *P. colensoi* may result in the recognition of further taxa. This notion may be supported by Hatch (1947), who records this species as having up to forty flowers when fewer than twenty are consistently reported in the literature.

TYPIFICATION
This species will be lectotypified in a forthcoming publication (Molloy, Clements and Jones in prep.).

CONSERVATION STATUS
Widely distributed, common and well conserved.

SPECIMENS EXAMINED
NEW ZEALAND: Canterbury, no date, *Haast* (MEL); Roto Itu, no date, *Kirk* (MEL); New Zealand, no date, *Travers* (MEL); Bryant Ra., Nelson, 27 Dec. 1990, *Jenks* (CHR); Puffer Tk, Wellington, 13 Dec. 1990, *Molloy* (CHR); Windy Point, Canterbury, 13 Nov. 1990, *Molloy* (CHR); Ahuriri, Pont Hills, Canterbury, 17 Dec. 1990, *Molloy* (CHR); Dunedin, Otago, 24 Dec. 1990, *St.George* (CHR); Mt Herbert, Canterbury, 3 Jan. 1991, *Molloy* (CHR); Lake Lyndon, Canterbury, 4 Jan. 1991, *Molloy* (CHR).

3. *Prasophyllum tadgellianum* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 47:338-339 (1923). TYPE: Victoria, Mount Bogong, 7 Feb. 1923, *A.J. Tadgell in herb.*

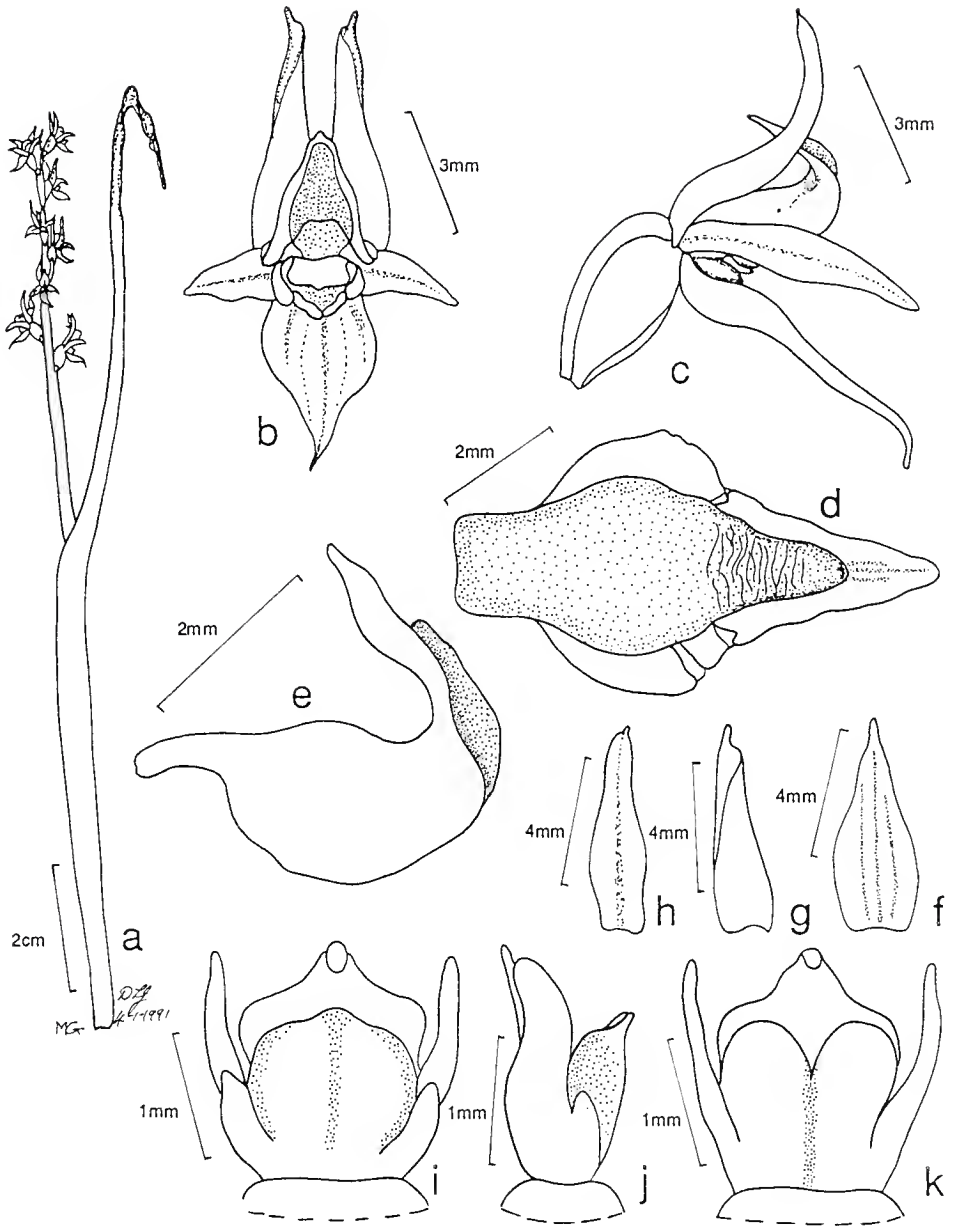

Fig. 2. *Prasophyllum colensoi* J.D.Hook. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - labellum from side. f - dorsal sepal flattened out. g - conjoined lateral sepals. h - petal. i - column from rear. j - column from side. k - column from front. All drawn from *Lynden s.n.* (CBG).

R.S. Rogers 2954a (LECTOTYPE: AD; *fide* Clements 1989; ISOLECTOTYPE: BM, K, MEL).

Prasophyllum frenchii F.Muell. var. *tadgellianum* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 46: 153-154 (1922). TYPE: Victoria, Mount Hotham, 4 Dec. 1914, *A.J. Tadgell in herb. R.S. Rogers* (LECTO: AD; *fide* Clements 1989).

Illustrations: (all as *Prasophyllum alpinum*) W.H. Nicholls, *Orchids of Australia*, complete ed., plate 138 (1969); C.E. Gray, *Victorian Native Orchids*, vol. 1, 78 (1966); N.T. Burbidge and M. Gray, *Flora of the A.C.T.*, fig. 111A (1970); A.B. Costin, M. Gray, C.J. Toterdell and D.J. Wimbush, *Kosciusko Alpine Flora*, plates 145 & 146 (1979).

Solitary or tufting terrestrial tuberous herb 10-22 cm tall. *Tubers* 6-8 mm across, ovoid, irregular. *Leaf* 10-20 cm long, 4-8 mm across at the widest point, dark green and shiny, base white to green, free lamina 4-8 cm long, moderately stiff, turgid erect or shallowly incurved or recurved. *Raceme* 5-8 cm long, the peduncle often enclosed by the leaf at anthesis, bearing 8-20 subsessile, crowded flowers. *Floral bracts* broadly ovate, c. 3 mm long, c. 3 mm wide, closely sheathing, subacute to apiculate. *Ovary* obpyriform, c. 4 mm long, c. 3 mm wide, set at about 35° to the rachis, the ribs darker. *Flowers* 10-12 mm long, dark greenish brown to dark reddish brown, lightly scented, the tepals spreading widely. *Dorsal sepal* ovate-lanceolate, 5.5-6.5 mm long, 2.3-2.6 mm long, with 3 brown striae, decurved, subacute. *Lateral* sepals connate except near the apex, obliquely erect, recurved in distal half, involute near the apex. *Petals* narrowly linear-lanceolate, 5-5.5 mm long, c. 1 mm wide, porrect or slightly decurved, usually incurved near the apex. *Labellum* more or less ovate-lanceolate in outline when flattened, margins suddenly incurved near the middle, 4.3-4.6 mm long, 2.5-2.8 mm wide, shortly stalked to subsessile, greenish, whitish or pinkish, proximal half erect to slightly recurved, the margins entire or slightly undulate; callus occupying most of the ventral surface of the lamina and of similar shape, raised, green, shiny, fleshy, smooth, extending nearly to the labellum apex. *Column* porrect from the end of the ovary, c. 1.5 mm long, c. 2 mm wide; appendages narrowly oblong, as high as the anther, obtuse, whitish, c. 1.5 mm long, 0.5 mm wide, with connate basal lobes c. 0.6 mm long. *Anther* ovate, c. 1.3 mm long, 1.5 mm wide, brownish to purplish, rugulose; rostrum short, obtuse. *Pollinarium* c. 1 mm long; viscidium c. 0.2 mm long, oblong, white; hamulus c. 0.2 mm long, ligulate; pollinia c. 0.9 mm long, linear-clavoid, yellow, sectile. *Stigma* reniform, c. 1.3 mm long, 0.8 mm wide, the rostellum about as high as the appendages. *Capsule* obovoid c. 6.5 mm long, c. 4.5 mm wide, green with purplish ribs. (Fig. 3)

FLOWERING PERIOD
January to March

DISTRIBUTION AND HABITAT
South-easten Australia, south from the Brindabella Ranges (A.C.T.) and Snowy Mountains in south-eastern New South Wales, Victoria (north-east and eastern highlands) and Tasmania (Cradle Mountain). Grows in subalpine herbfield, commonly in tussock grassland but also in seepage areas and around the margins of bogs and streams; occasionally among snow gums; rarely in feldmark.

NOTES
Prasophyllum tadgellianum has been commonly treated as a synonym of *P. alpinum* in the literature, but the the two are morphologically distinct (see *P. alpinum* entry) and their ranges rarely overlap. *Prasophyllum tadgellianum* is more likely to be confused with *P. sphacelatum* since they are commonly sympatric. *Prasophyllum tadgellianum* can be distinguished from the latter species by its shorter, stouter habit (plants 10-22 cm tall), a moderately stout, stiff, turgid leaf lamina (hardly withered at anthesis), shorter racemes (5-8 cm long) with the flowers usually crowded and the perianth segments overlapping, smaller flowers (10-12 mm long), a smaller, nearly sessile labellum

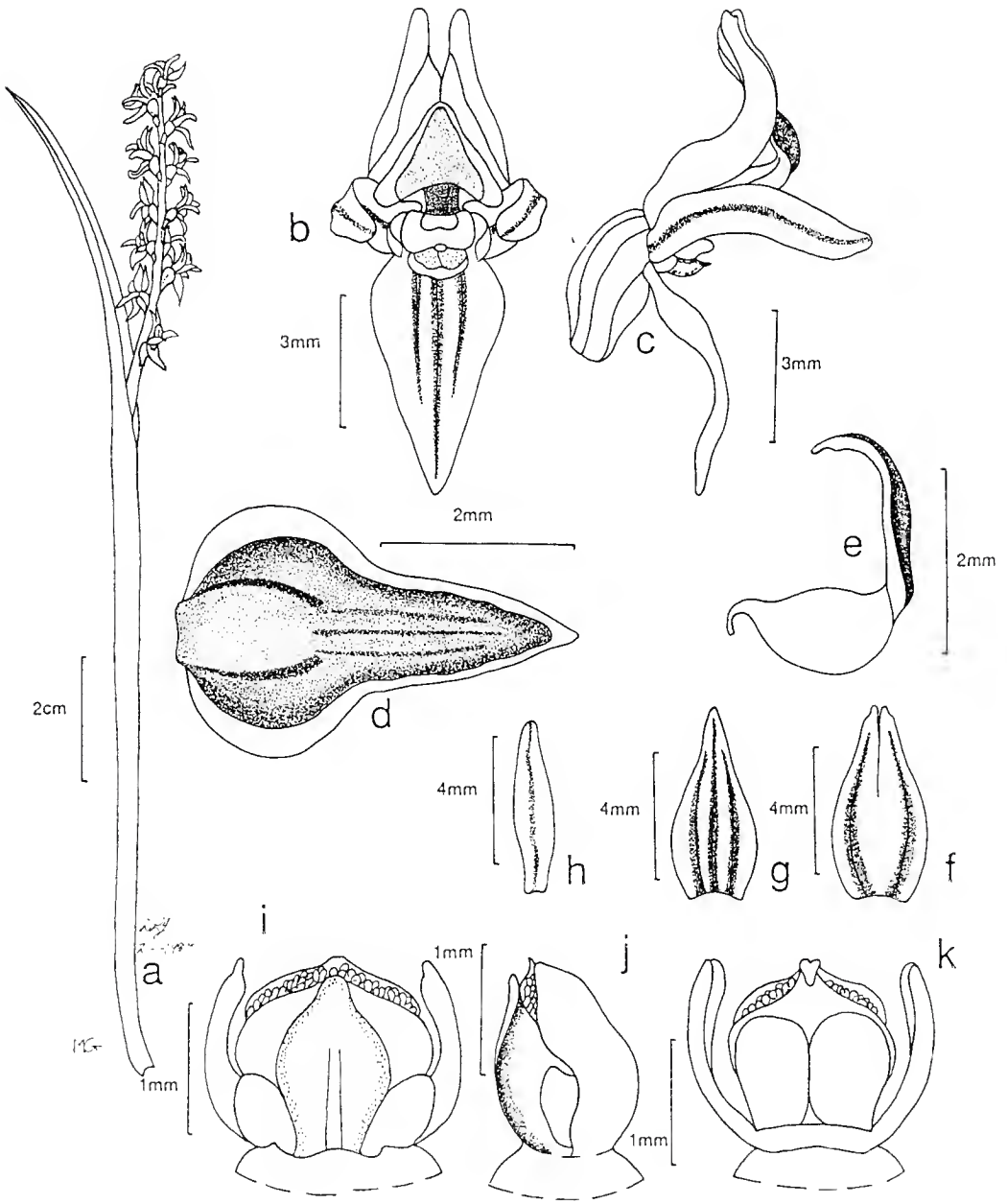

Fig. 3. *Prasophyllum tadgellianum* R.S.Rogers. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - labellum from side. f - dorsal sepal flattened out. g - conjoined lateral sepals. h - petal. i - column from rear. j - column from side. k - column from front. All drawn from *Jones 3464* (CBG).

(4.3-4.6 mm x 2.5-2.8 mm), a thinner, more tapered lamina callus and a proportionately broader column (1.5 mm x 2 mm) with narrower column wings (0.5 mm wide). *Prasophyllum tadgellianum* tends to favour higher altitudes than *P. sphacelatum* (c. 1700 m to c. 2000 m alt.), growing mainly in subalpine and alpine meadows (rarely feldmark) and reaching its peak of flowering 2-3 weeks later than that species in areas where both grow sympatrically.

Prasophyllum tadgellianum is similar morphologically to *P. colensoi* but can be distinguished by the moderately stout, stiff, turgid leaf lamina (hardly withered at anthesis), narrower, linear-lanceolate petals, the nearly sessile labellum, the lateral sepals being connate throughout and the rounded stigmatic plate which is about as long as the anther.

CONSERVATION STATUS

Widespread, common and conserved in National Parks.

SELECTED SPECIMENS (84 examined)

NEW SOUTH WALES: Lake Albina, Kosciusko National Park, 10 Mar. 1969, *Pickard & Coveny 2725* (NSW, MEL); Mt Kosciusko, 16 Jan. 1953, *Gauba* (CANB); Mt Carruthers, Kosciusko National Park, 7 Feb. 1972, *Whitehead & Clemesha* (CBG).

VICTORIA: Wombargo Range, 11 Jan. 1971, *Beauglehole 35993* (MEL); Diggers Hole Ck. NW of Mt Nunniong, 22 Jan. 1971, *Beauglehole 36436 & E.W.Finck* (MEL); Cobberas No.1, 25 Jan. 1971, *Beauglehole 36487 & E.W.Finck* (MEL); summit of Mt Baw Baw, 12 Feb. 1965, *Jones* (MEL); Harrietville, Jan. 1932, *Mathews* (MEL); near Wilkinson's Memorial Hut, Bogong High Plains, 18 Jan. 1959, *Muir 662* (MEL); Mt Howitt, Dec. 1934, *Nicholls*, (MEL); Mt Buffalo, Dec. 1939, *Stewart* (MEL); Lankeys Plain, Dargo High Plains, 1 Jan. 1982, *Walsh 721*, (MEL).

TASMANIA: Fury Plains, c. 6 km before Waldheim, 24 Jan. 1974, *Allen* (HO); February Plains, 28 Jan. 1983, *Moscal 1547* (HO).

4. *Prasophyllum sphacelatum* D.L.Jones, *sp. nov.*

affinis *Prasophyllum tadgelliano* R.S.Rogers a qua altiore, plerumque exiliore, lamina flaccida plerumque marcida, racemo floribus sparsioribus majoribusque, labello majore distincte unguiculato, callo crasso obtusiore, et columna alis latioribus proportione perangustiore differt.

TYPE: New South Wales; Southern Tablelands; c. 7 km along Tantangara Dam Rd, 3 Jan 1993, *D.L. Jones 11102 and B.E. Jones* (HOLOTYPE: CANB; ISOTYPE: CANB, NSW, MEL, AD)

Illustrations: (all as *Prasophyllum alpinum*) E.R. Rotherham *et al.*, *Flowers and Plants of New South Wales and Southern Queensland*, plate 343 (1975); D.L. Jones, *Native Orchids of Australia*, 248 (1988).

Solitary or tufting terrestrial tuberous herb 20-38 cm tall. *Tubers* 8-12 mm across, ovoid, irregular. *Leaf* 28-38 cm long, 2-4 mm across at the widest, dull green, base white to reddish purple, free lamina 8-14 cm long, erect to flaccid, usually withered towards the apex. *Raceme* 8-14 cm long, bearing 6-18 subsessile, well-spaced to moderately crowded flowers. *Floral bracts* broadly ovate, c. 3 mm long, c. 3 mm wide, closely sheathing, subacute. *Ovary* obpyriform, c. 4 mm long, 3 mm wide, set at about 40° to the rachis. *Flowers* 14-18 mm long, green to reddish brown, strongly scented, the tepals spreading widely. *Dorsal sepal* ovate-lanceolate, 6.5-8 mm long, 3-4 mm wide, decurved, subacute, often with pale marginal bands. *Lateral sepals* ranging from completely free to completely connate, obliquely erect, straight or recurved in distal half, involute near the apex. *Petals* linear to narrowly linear-lanceolate, 6.5-7.5 mm long, 1-1.2 mm wide, obliquely erect to porrect, sometimes incurved near the apex. *Labellum* more or less ovate-lanceolate in outline when flattened, margins gradually incurved near the middle, 6-7.5 mm long, 3-3.5 mm wide, distinctly clawed, greenish to pinkish, proximal half erect to recurved, the margins undulate to slightly crisped; callus occupying most of the ventral surface of the lamina and of similar shape, raised, green, shiny,

smooth to wrinkled, extending nearly to the labellum apex. *Column* porrect from the end of the ovary, c. 2 mm long, c. 2 mm wide; appendages broadly obovate, as high as the anther, broadly obtuse to emarginate, c. 2 mm long, 0.7 mm wide, with connate basal lobes c. 1 mm long. *Anther* ovate, c. 1.7 mm long, 1.5 mm wide, brownish to purplish, rugulose; rostrum short, obtuse. *Pollinarium* c. 1.5 mm long; viscidium c. 0.25 mm long, oblong, white; hamulus c. 0.15 mm long, ligulate; pollinia c. 1.2 mm long, linear-clavoid, yellow, sectile. *Stigma* ± reniform, c. 1.2 mm long, c. 1 mm wide, the rostellum about as high as the appendages. *Capsule* obovoid, c. 8 mm long, c. 5 mm wide, green, shiny. (Fig. 4)

FLOWERING PERIOD

December to early February.

DISTRIBUTION AND HABITAT

South-eastern Australia, south from the Brindabella Ranges (A.C.T.) and Snowy Mountains in south-eastern New South Wales and eastern Victoria (north-east and eastern highlands). It grows in subalpine herbfield, often in tussock grassland, and in seepage areas as well as among grass and shrubs in snow gum (*Eucalyptus pauciflora* Sieber ex Sprengel) forest.

NOTES

Prasophyllum sphacelatum has been commonly confused in the literature with *P. alpinum* but the two species are morphologically distinct (see *P. alpinum* entry for its distinguishing features). The geographic ranges of the two do not overlap and *P. sphacelatum* is more likely to be confused in the field with *P. tadgellianum*, with which it is often sympatric. *Prasophyllum sphacelatum* can be distinguished from the latter species by its taller, more slender habit (plants 22-38 cm tall), an erect to flaccid leaf lamina which is usually withered towards the apex at flowering time, longer racemes (8-14 cm long) with the flowers sparse and the perianth segments hardly overlapping, larger flowers (14-18 mm long), a larger, distinctly stalked labellum (6-7.5 mm x 3-3.5 mm), a thicker, hardly tapered lamina callus and a proportionately narrower column (2 mm x 2 mm) with broader column wings (0.7 mm wide). *Prasophyllum sphacelatum* tends to favour lower elevations than *P. tadgellianum* (c. 1400 m to c. 1700 m alt.), grows among snow gums and in subalpine meadows and reaches its peak of flowering 2-3 weeks earlier than *P. tadgellianum* where the two species grow sympatrically.

CONSERVATION STATUS

Widespread, common and conserved in National Parks.

ETYMOLOGY

Derived from the Greek, *sphakelos*, necrosis, mortification, describing the withered leaf tip at anthesis.

SELECTED SPECIMENS (44 examined)

AUSTRALIAN CAPITAL TERRITORY: Murray's Gap, Bimberi Ra., 3 Jan. 1962, *Burbidge & Gray s.n.* (CANB); Mt Gingera, 10 Jan. 1963, *Gray s.n.* (CANB).

NEW SOUTH WALES: Rocky Gully Plains, Kiandra-Adaminaby Rd, 21 Dec. 1985, *Clements 3931* (CBG); Rules Point, 5 Jan. 1986, *Clements 3939* (CBG).

VICTORIA: souree of Murray River, N of Cobberas, 5 Jan. 1992, *Bates* (AD, MEL); Rocky Plain, 6 Jan. 1971, *Beauglehole 35869 & Rogers* (MEL); Lake Hill, SW of Nunniong Plain, 20 Jan. 1971, *Beauglehole 36341 & Finck* (MEL); Bryees Plain, 10 miles [16 km] SE of Mt Hotham, 18 Jan. 1967, *Muir 4548* (MEL); upper western slopes of Mt Cobberas No.1, 25 Jan. 1970, *Muir 4819* (MEL); near Howitt Hut, Dec. 1934, *Nicholls s.n.* (MEL).

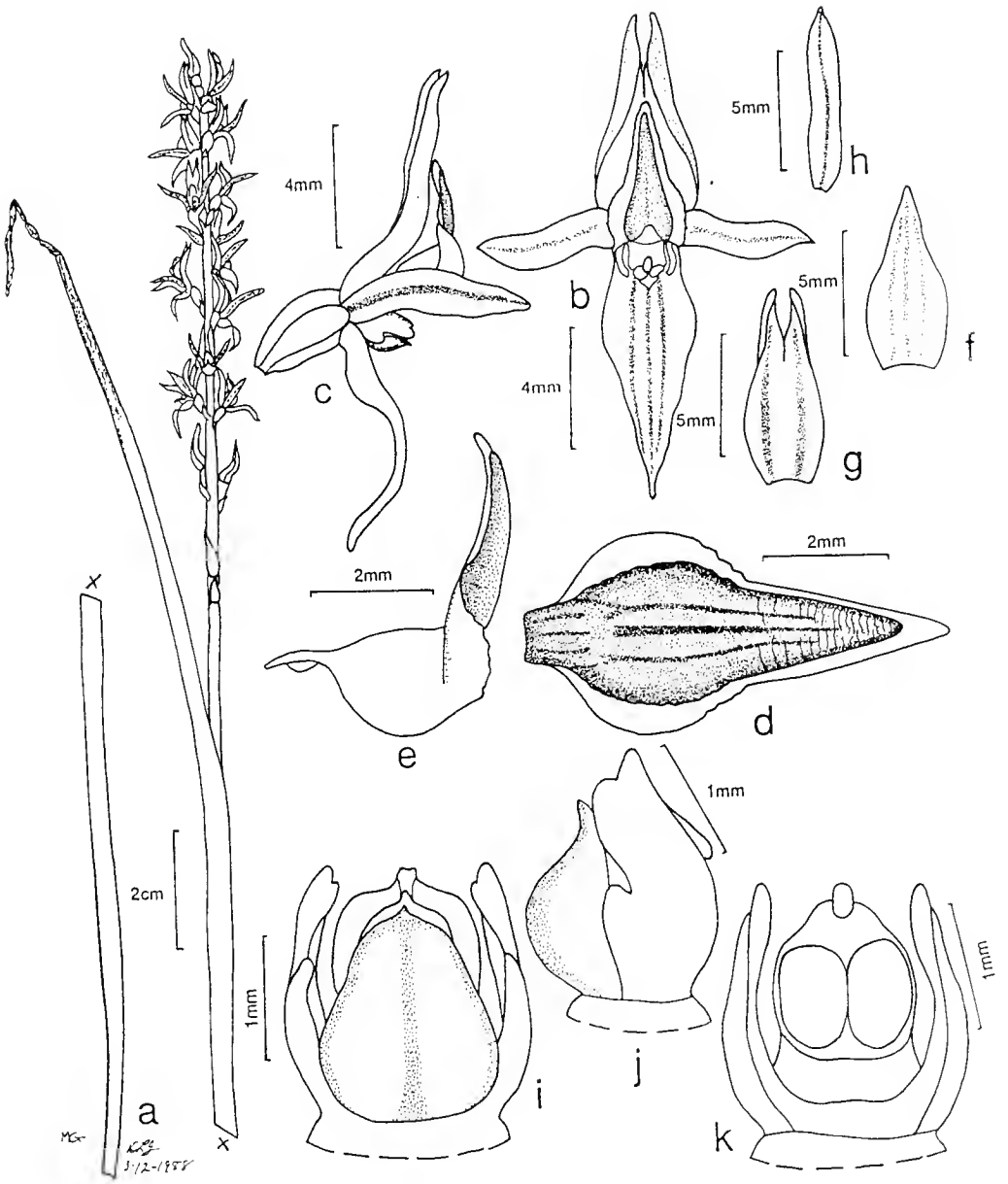

Fig. 4. *Prasophyllum sphacelatum* D.L.Jones. a - plant habit. b - flower from front. c - flower from side. d - labellum from above, flattened out. e - labellum from side. f - dorsal sepal flattened out. g - conjoined lateral sepals. h - petal. i - column from rear. j - column from side. k - column from front. All drawn from *Jones 3441* (CBG).

Acknowledgements
I thank David Ziegeler and Hans and Annie Wapstra for collecting specimens of *Prasophyllum alpinum* from Mount Wellington and Brian Molloy for supplying material of *P. colensoi*. Specimens were also supplied by Les Rubenach, Ross Smith, Peter Branwhite, Paul Barnett and Geoff Beilby. Corinna Broers and Barbara Jones provided valuable technical assistance throughout the project. Marion Garratt is thanked for her assistance in preparing the illustrations from my sketches. Lyn Craven prepared the Latin diagnosis and Mark Clements, Mike Crisp and Bob Bates commented on the manuscript. The Directors of the Australian Orchid Foundation are thanked for their support of field operatives. I also express my thanks to the directors of the herbaria AD, CHR, HO, MEL for the loan of specimens.

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Two new endemic species of *Sagina* L. (Caryophyllaceae) from Australia

L.G. Adams

Centre for Plant Biodiversity Research, G.P.O. Box 1600, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT
Sagina namadgi and *S. diemensis* from SE Australia are newly described and illustrated, and their ecology briefly discussed. A key to all *Sagina* spp. recorded from Australia is provided.

Introduction

Prior to about 1960, all Australian specimens of *Sagina*, apart from the predominantly coastal *S. maritima* G.Don (possibly native here) had been equated with the cosmopolitan adventives *S. apetala* Ard. or *S. procumbens* L., in the case of perennials mostly the latter. In 1962 M. Gray (*in sched.*) and other taxonomists at CANB noticed that a form of '*S. procumbens*' collected from the Brindabella Range, A.C.T. had some anomalous features. For example, seed of this taxon was quite unlike that of *S. procumbens*, being larger and much more rounded, lacking a dorsal groove, and with a glossy (not dull), colliculate (not tuberculate) testa. Following examination of further material of '*S. procumbens*', it became apparent that a long-overlooked, undescribed, indigenous taxon exists, and furthermore is quite widespread in cool-temperate SE Australia. It is here described as *S. namadgi*.

In the early 1980s another indigenous species was found, collected on and near Mt Anne, in southwestern Tasmania. This taxon has the same seed type as *S. namadgi* (although not nearly as glossy), but differs in other aspects, mainly its habit, the indumentum of its foliage, and its relatively conspicuous white flowers. It is here described as *S. diemensis*.

Taxonomy

1. *Sagina namadgi* L.G. Adams, *sp. nov.* ('sp. A' *in sched.*)
Sagina sp., N.T. Burb. & M. Gray, *Flora of the Australian Capital Territory*, p. 162 (1979).
[*Sagina procumbens sensu* J.Thomps. & M.Gray, *Telopea* 2(3): 318 (1981), *pro parte min., non* L.]

Simulans *S. procumbenti*, sed sepalis c. 1.5 mm longis, et seminibus atrofuscis vel nigribus reniformibus ad subglobosis sine sulco dorsali, differt; et ab *S. diemensi* sepalis ad basim leviter rotundatis, et seminibus splendentibus, 0.4-0.5 mm longis, differt.

HOLOTYPUS: Australian Capital Territory: c. 10 miles [16 km] N of Boboyan homestead, 35°43'S 149°00'E, alt. c. 1000 m, 17 Feb. 1963, *L.G. Adams 539* (CANB 152061).

Perennial, entirely glabrous, with fibrous roots often adventitious from nodes. *Stems* lax, diffusely branching and often stoloniferous, 2-15 cm long; basal leaf-rosette absent at anthesis. *Leaves* sessile, linear, the apex acute or mucronulate, not aristate, 4-10 mm long, 0.3-0.5 mm wide. *Flowers* 4-merous. *Pedicels* 4-15 mm long, in fruit at first deflexed immediately below capsule, later erect. *Sepals* broad-ovate to suborbicular, ± 1.5 mm long, with narrow scarious margins, becoming appressed to ripe fruit. Petals

broad-obovate, entire, white, ± half length of sepals. *Stamens* 4 or 8. *Styles* 3 or 4. *Capsule* broad-ovoid to subglobose, 2-3 mm long, up to twice length of sepals. *Seeds* ±glossy, dark grey or black, tumid-reniform to subglobose, not grooved dorsally, bluntly colliculate, 0.4-0.5 mm long. (Fig. 1 a-e)

DISTRIBUTION AND ECOLOGY

Sagina namadgi is indigenous to cool-temperate eastern Australia, occurring in sub-alpine flushes, sphagnum bogs and on creek margins, often in *Eucalyptus pauciflora* woodland. Recorded associated species are: *Callistemon ?pityoides*, *Leptospermum* sp., *Ranunculus pimpinellifolius*, *Plantago antarctica*, *Carex* spp., *Cyperus* sp., *Schoenus* sp., *Epilobium* sp., *Spiranthes sinensis* and *Utricularia dichotoma*. Like the adventive *Sagina* spp. it is an inconspicuous plant, no doubt often overlooked (or passed over in mistake for the naturalised perennial *S. procumbens* L., to which it bears a superficial resemblance), and thus probably more common than current records indicate.

NOTES

The new species is most readily distinguished from all others occurring in Australia by the combination of its glabrous, perennial habit, awnless leaves, the basal rosette absent at flowering, non-spreading sepals in fruit, and significantly different seeds.

ETYMOLOGY

The epithet commemorates Namadgi National Park, A.C.T., whence came the first collections to be recognised as a taxon new to science.

ADDITIONAL SPECIMENS EXAMINED

AUSTRALIAN CAPITAL TERRITORY: entrance gate, Gudgenby Station, 23 Dec. 1958, *N.T. Burbidge 6215 & M. Gray* (CANB); Murrays Gap, Bimberi Range, 12 Feb. 1961, *N.T. Burbidge 6955* (CANB).

NEW SOUTH WALES: Tia River, near Walcha., Nov. 1897, *J.H. Maiden s.n* (NSW); Jindabyne., Jan. 1899, *J.H. Maiden & W. Forsyth s.n* (NSW); Ben Lomond, Dec. 1899, *J.H. Maiden s.n.* (NSW); Happy Jacks Plain, headwaters of Happy Jacks River, c. 24 km S of Kiandra, 18 Jan. 1958, *J. Thompson s.n.* (NSW); Sherlock Creek, 16 km S of Captains Flat, 25 Dec. 1965, *B.G. Briggs s.n.* (NSW); Cave Creek, 29 km NNE of Kiandra, alt. 1200 m, 12 Dec. 1969, *R. Coveny 2675a & A. Rodd* (NSW); Dead Horse Gap on Jindabyne-Khancoban road, 8 km S of Mt Kosciusko summit, 26 Feb. 1974, *B.G. Briggs 4780* (NSW).

VICTORIA: Rocky Plain, c. 24 km W of Wulgulmerang, 3 Feb. 1968, *K. Rogers s.n.* (MEL).

TASMANIA: King's Island [= King Island, 39°55'S 144°00'E], Nov. 1887, *C. Walter s.n.* (NSW); Pegg Creek, Hartwell Cove, *A. Moscal 10020* (HO, AD).

2. *Sagina diemensis* L.G. Adams, *sp. nov.* ('sp. B' *in sched.*)

Simulans *S. procumbenti*, sed planta plerumque glandulo-hirta ubique, petalis conspicuis quam sepalis longioribus, et seminibus sine sulco dorsali, differt; et ab *S. namadgi* sepalis ad basim saccatis porcatis, et seminibus impolitis, 0.5-0.7 mm longis, differt.

HOLOTYPUS: Tasmania: crevices in dolomite outcrops, NE ridge of Mt Anne, 42°56'S 146°26'E, alt. 980 m, 31 Dec. 1984, *A.M. Buchanan 5115* (HO 88950).

Cushion-forming perennial, glandular-hairy throughout (rarely glabrous), with fibrous roots often adventitious from nodes. *Stems* lax, stoloniferous, up to 10 cm long, diffusely branching laterally from short caudex that bears a non-flowering leaf-rosette. *Leaves* sessile, linear, the apex acute or shortly mucronulate, usually glandular-ciliate, 2-10(-14) x 0.2-0.5 mm, usually with narrow scarious margins. *Flowers* 4-merous. Pedicels erect, at no time deflexed, 6-12 mm long. *Sepals* oblong-elliptic with saccate, ± ridged base, 2-2.5 mm long, the scarious margins often purple-tinged, ± appressed to ripe fruit. *Petals* ovate to suborbicular, entire, white, 2.5-3.5 mm long, rarely absent. *Stamens* 4 or 8. *Styles* 4. *Capsule* ovoid, 2.5-2.75 mm long, slightly longer than sepals. *Seeds* matt or scarcely glossy, dark reddish brown, oblique-reniform, not grooved dorsally, bluntly tuberculate, 0.5-0.7 mm long. (Fig. 1 f-j)

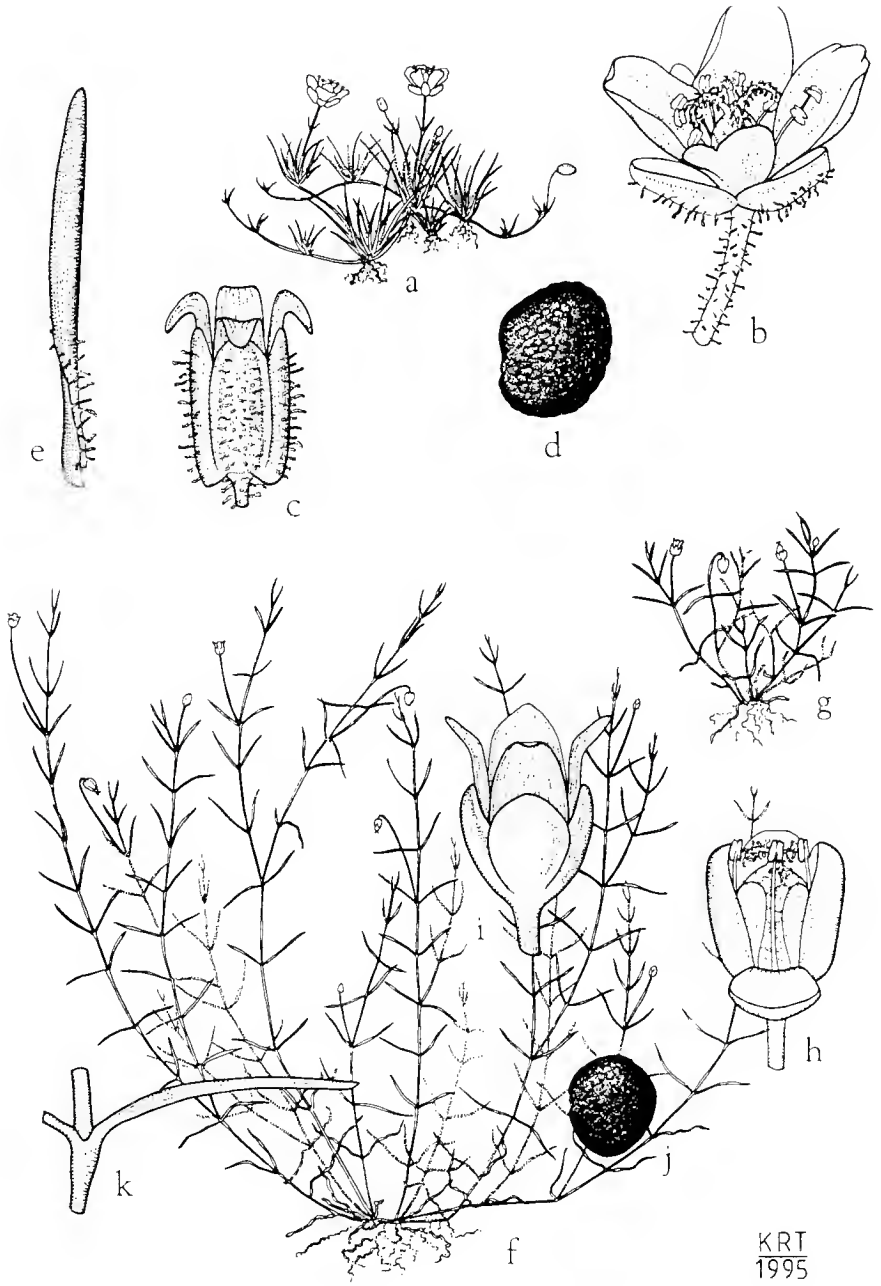

Fig. 1. a-e *Sagina diemensis*. a - habit x1. b - flower x6. c - dehisced capsule and sepals x8. d - seed x30. e - leaf x5. f-j *Sagina namadgi*. f - habit (lax plant) x1. g - habit (small plant) x1. h - flower, with sepal drawn back to show internal organs x15. i - dehisced capsule and sepals x10. j - seed x30. k - leaf and node x5.

DISTRIBUTION AND ECOLOGY

Sagina diemensis is known only from the immediate vicinity of Mt Anne and headwaters of the Weld River, southwestern Tasmania, occurring on dolomite outcrops. Recorded associated species are *Danthonia diemenica*, *Isolepis* sp., *Oreomyrrhis gunnii* and *Oreoporanthera petalifera*.

NOTES

Sagina diemensis is readily distinguished from other *Sagina* species by its persistent basal leaf-rosette, usually strongly glandularly-hairy foliage and inflorescence, and when in flower, by the saccate base of the sepals and the relatively conspicuous white corolla. A single collection (*J. Davies 30*) from the same area as the type is entirely glabrous and lacks petals; it is otherwise closely similar to typical *S. diemensis* (particularly in the size, shape and ornamentation of the seeds) and seems to be an aberrant form of it.

ETYMOLOGY

The epithet refers to Van Diemen's Land, the early name for Tasmania, where the taxon seems to be endemic.

ADDITIONAL SPECIMENS EXAMINED

TASMANIA: Mt Anne, *J.B. Davies DN 547465* (HO); Weld Arch, Weld River, alt. 360 m, 17 Jan. 1988, *D. Ziegeler s.n.* (HO); Mt Anne, NE ridge, alt. 980 m, 30 Dec. 1984, *J. Davies 30* (HO); *ibid.*, alt. 980 m, 31 Dec. 1984, *A.M. Buchanan 5104* (HO); *ibid.*, alt. 850 m, 20 Jan. 1990, *L. Gilfedder ANBG 2228* (CBG).

KEY TO SPECIES IN AUSTRALIA

1 Seeds with dorsal margin flattened or grooved 2
1: Seeds with dorsal margin rounded, never flattened or grooved 4
2 Perennial with fibrous roots, often adventitious from nodes; stems diffusely branching with sterile axillary shoots common, often mat-forming; sepals in mature fruit broad-ovate to suborbicular ..... ***Sagina procumbens***
2: Annual with slender branching tap-root; stems erect or ascending, lacking sterile axillary shoots and rarely mat-forming; sepals in mature fruit ovate 3
3 Leaves (at least the upper) often basally ciliate, the apex subulate, aristate; inflorescence often glandular; sepals in fruit spreading, usually distinctly shorter than capsule ..... ***Sagina apetala***
3: Leaves never ciliate, the apex obtuse or acute, often mucronulate but not aristate; inflorescence never glandular; sepals in fruit erect, ± equalling capsule ..... (?*)***Sagina maritima***
4 Plant glandular-hairy throughout (rarely glabrous); basal leaf-rosette persistent; sepals 2-2.5 mm long with saccate, ± ridged base, a little shorter than mature capsule; petals distinctly longer than sepals; seeds ± matt, dark reddish brown, 0.5-0.7 mm long ..... ***Sagina diemensis***
4: Plant always glabrous; basal leaf-rosette absent at flowering; sepals ± 1.5 mm long with smoothly rounded base, much shorter than mature capsule; petals much shorter than sepals; seeds glossy, dark grey or black, 0.4-0.5 mm long ..... ***Sagina namadgi***

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Muelleria 9: 67–73 (1996)

Miscellaneous notes on *Genoplesium ciliatum* (Ewart & B.Rees) D.L.Jones & M.A.Clem. (Orchidaceae)

David L. Jones[1] *& Jeffrey A. Jeanes*[2]

[1] Centre for Plant Biodiversity Research, G.P.O. Box 1600, Canberra, 2601, Australian Capital Territory, Australia.
[2] National Herbarium of Victoria, Royal Botanic Gardens, Melbourne, Birdwood Avenue, South Yarra, 3141, Victoria, Australia.

ABSTRACT
The identity of *Genoplesium ciliatum* (Ewart & B.Rees) D.L.Jones & M.A.Clem. is established and a full description provided. Its relationship with other members of the *Genoplesium archeri* (Hook.f.) D.L.Jones & M.A.Clem. complex is discussed and a preliminary key provided.

Introduction

Genoplesium ciliatum (Ewart & B.Rees) D.L.Jones & M.A.Clem. has had a rather interesting taxonomic history and remains poorly known today. The main reasons for this appear to be the minimal information supplied in the type description, both taxonomic and ecological, and the lack of any subsequent attempt by botanists to resolve the identity of the taxon. This paper clarifies various aspects of the species.

Methods

This study is based on the morphological examination of fresh flowers collected from localities in Victoria and South Australia, dried and spirit-preserved herbarium specimens from AD, CANB, CBG and MEL and photographs of living flowers of the taxa involved. Type specimens of all pertinent taxa have been examined. Measurements given in the description are from living plants. Notes on Victorian distribution, habitat (particularly soil and plant association) and conservation status were derived from our own field studies; those from South Australia were from R. Bates and D. Murfet.

Taxonomic history

Following the description of *Prasophyllum ciliatum* by Ewart & Rees (1912), the species was discussed at various depth in three publications, Pescott (1928), Dickens (1929) and Ewart (1931). Nicholls (1931) reduced it to synonymy under *Prasophyllum archeri* Hook.f. (= *Genoplesium archeri*) and this approach was followed by others: Willis (1962), Nicholls (1969), Woolcock & Woolcock (1984) and Clements (1989). Jones and Clements (1989) restored the species when reinterpreting the genus *Genoplesium* and made the new combination for the species. Recently, descriptions of the species have been given in Walsh and Entwisle (1994) and in Backhouse and Jeanes (1995). The description by Jones in Walsh and Entwisle (1994) is erroneous being based on a small, few-flowered variant of *G. archeri* which occurs in some coastal districts of Victoria.

Taxonomy

Genoplesium ciliatum (Ewart & B.Rees) D.L.Jones & M.A.Clem., *Lindleyana* 4(3): 142 (1989). *Prasophyllum ciliatum* Ewart & B.Rees, *Proc. Roy. Soc. Victoria* (new ser.)

25: 111, t. 6, fig. d-g (1912), basionym. TYPE: Green Valley, County of Talbot, Victoria, 19 June 1910, *F.M. Reader, herb. C.W. Sutton* (HOLOTYPE: MEL). *Prasophyllum archeri* Hook.f. var. *deirdrae* Nicholls, *Vict. Nat.* 49: 114 (1932). TYPE: Maryborough, Victoria, April 1932, *A. Chisholm* (HOLOTYPE: MEL), *syn nov.*
Illustrations: R.J. Bates & J.Z. Weber, *Orchids of South Australia*, plate 143 (as *Genoplesium archeri*) (1990); N.G. Walsh & T.J. Entwisle, *Flora of Victoria*, vol. 2, fig 188a-c, plate 16a-c (as *Genoplesium archeri*) (1994); G.N. Backhouse & J.A. Jeanes, *The Orchids of Victoria*, p. 194 (1995).

Terrestrial tuberous herb. Leaf 5-13 cm long, 1-1.5 mm wide, terete, reddish at the base; lamina 6-13 mm long, 2-2.5 mm wide, subulate, sheathing the scape, ending 10-15 mm below the lowest flower. *Inflorescence* 6-15 cm tall, bearing (1-)5-8(-15) flowers in a crowded spike 0.5-2(-3) cm long. *Flowers* 4-5 mm across, green or yellowish green with pale purple striae, nodding to porrect, with porrect to obliquely erect lateral sepals. *Ovary* linear-ovoid, 3-3.5 mm long, curved. *Dorsal sepal* c. 4 mm long, c. 2.4 mm wide, broadly ovate, cucullate, glabrous, green to yellow-green, margins with a pale purple narrow band, three similar longitudinal bands often also present. *Lateral sepals* linear-lanceolate, c. 5 mm long, c. 1.2 mm wide, slightly gibbous at the base, green to yellow-green, parallel or slightly divergent, distal margins incurved, apex eglandular or with a vestigial gland. *Petals* narrow-ovate, c. 3.7 mm long, c. 1.5 mm wide, acuminate, deflexed, greenish with pale purple stripes and marginal bands, glabrous. *Labellum* broadly elliptical to obovate-elliptical, 3-3.5 mm long, c. 2 mm wide, light reddish to reddish purple, thick and fleshy, distal margins with a few coarse spreading purple cilia c. 0.6 mm long, apex apiculate to subacuminate; callus narrowly ovate-oblong, occupying about one third of the ventral surface of the lamina, extending to the labellum apex, purplish black, thickest and broadest near the base then gradually tapered. *Column* c. 2 mm long, deflexed; foot c. 0.4 mm long, ligulate, curved. *Column wings* very shallowly notched, the lobes strongly dimorphic, hardly divergent; posterior lobe linear-oblong, c. 0.2 mm wide, pale, entire, obtuse; anterior lobe ovate-lanceolate, c. 0.5 mm wide, acuminate, mauve, coarsely denticulate-papillose. *Anther* c. 0.9 mm long, with a filiform rostrum c. 0.3 mm long. *Stigma* narrowly ovate-elliptical, c. 0.8 mm long, c. 0.6 mm wide. *Pollinarium* c. 1 mm long; pollinia c. 0.8 mm long, yellow, coarsely granular; caudicle c. 0.15 mm long; viscidium c. 0.15 mm across. *Capsule* obovoid, 5-6 mm long, 2-3 mm long, green. (Figs. 1 & 2)

FLOWERING PERIOD
February to June, depending upon quantity and timing of rainfall.

DISTRIBUTION
Widespread in central and western Victoria with an isolated eastern record from Wilsons Promontory National Park. Apart from localities in the specimens list below, plants of *G. ciliatum* have been located recently in the Victorian goldfields at Barfold, Sandon, Stawell and Deep Lead. They have also been observed in more mesic habitats near Bannockburn and on the Mornington Peninsula. In South Australia it is restricted to areas near Mt Compass and Mount Gambier (D. Murfet, *pers. comm.*, Bates and Weber 1990). (Fig. 3)

HABITAT
In inland areas it grows in grassy woodlands often favouring moist depressions, while nearer the coast it usually grows in heathlands and heathy woodlands, especially where the habitat has been opened up by regular slashing or mowing. Soils are usually well-drained sandy loams that may also be gravelly. In South Australia it grows on small hummocks in perched swamps (D. Murfet, *pers. comm.*).

TYPIFICATION
The holotype (labelled type no. 2000) consists of 2 specimens, that on the LHS (marked 'broad labella') with one flower and the one on the RHS (marked 'acuminate labella')

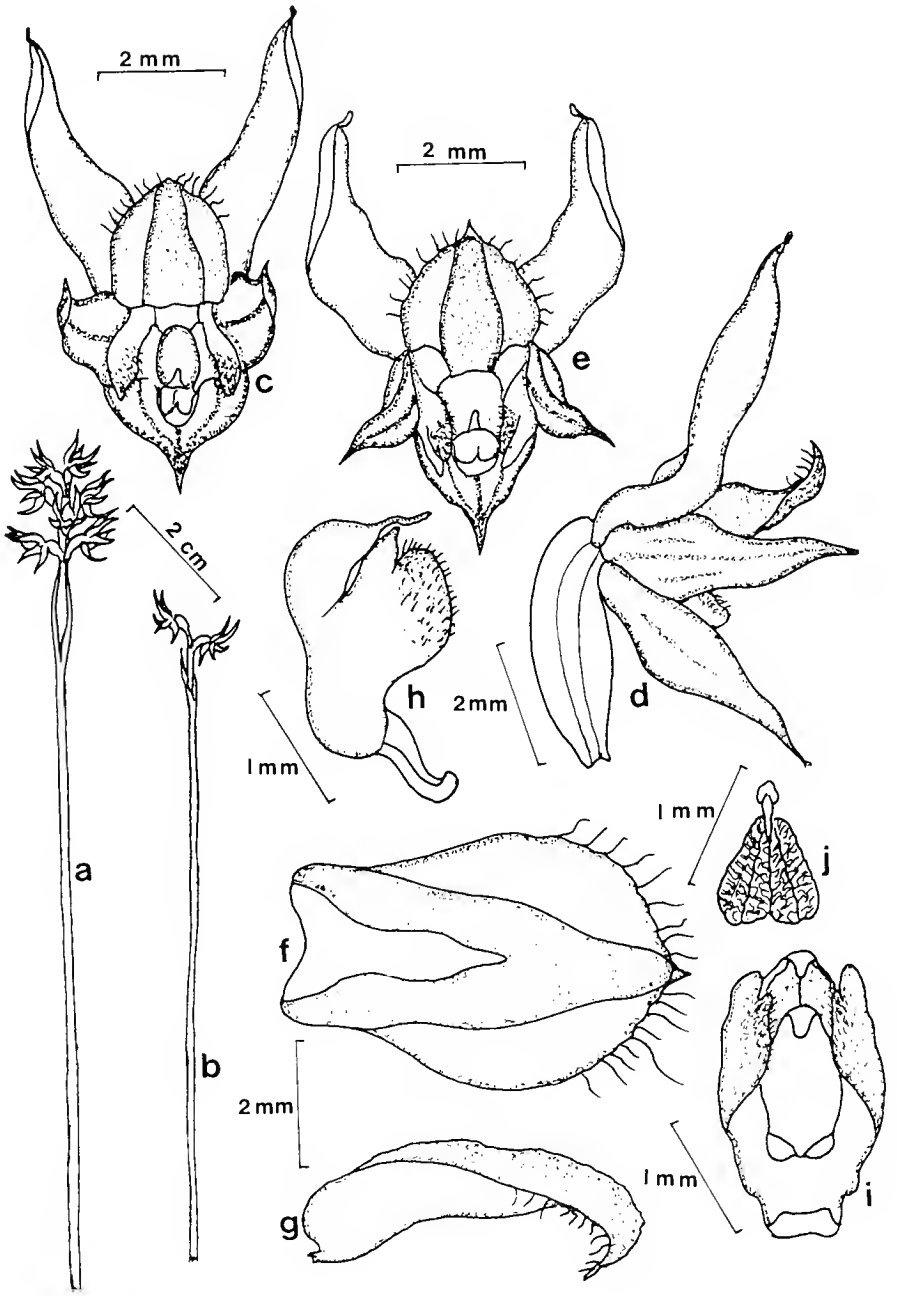

Fig. 1. *Genoplesium ciliatum* (Ewart & B.Rees) D.L.Jones & M.A.Clem. a & b - plant habit. c & e - flower from front. d - flower from side. f - labellum from above, flattened out. g - labellum from side. h - column from side. i - column from front. j - pollinarium. a, c, d, f-j, drawn from *Foster s.n.* (CBG); b & c, drawn from *Bates 27912* (CBG).

Fig. 2. *Genoplesium ciliatum in-situ*, Brisbane Ranges National Park.

with 2 flowers. Originally more flowers would have been present as Nicholls (1931) records that flowers from these specimens were removed and softened for drawing. The type collection was obviously made from plants in the later stages of flowering as evidenced by the swollen ovaries and nearly closed perianth segments on the specimens. Another collection at MEL (no. 1418, herb. C.S. Sutton) made on 11 May 1910 apparently by Reader at the type locality, is of interest because the specimen has 4 flowers and appears to have been pressed while these were in good condition. This is not part of the type collection (although it has been annotated as holotype) because the date is earlier than when the type collection was made. It is tempting to speculate that the specimens used as the type were collected subsequent to this earlier collection being received and perceived to be of interest.

Limited information about the species can be gained from the type description and illustrations because of the very brief nature of the description and rather poor quality of the accompanying line drawings which appear to have been drawn from material past its prime. The fringe of short cilia along the distal labellum margin, the papillate anterior lobes of the column appendages and glabrous petals show it to be a member of the *Genoplesium archeri* complex. No information is given as to the number of flowers,

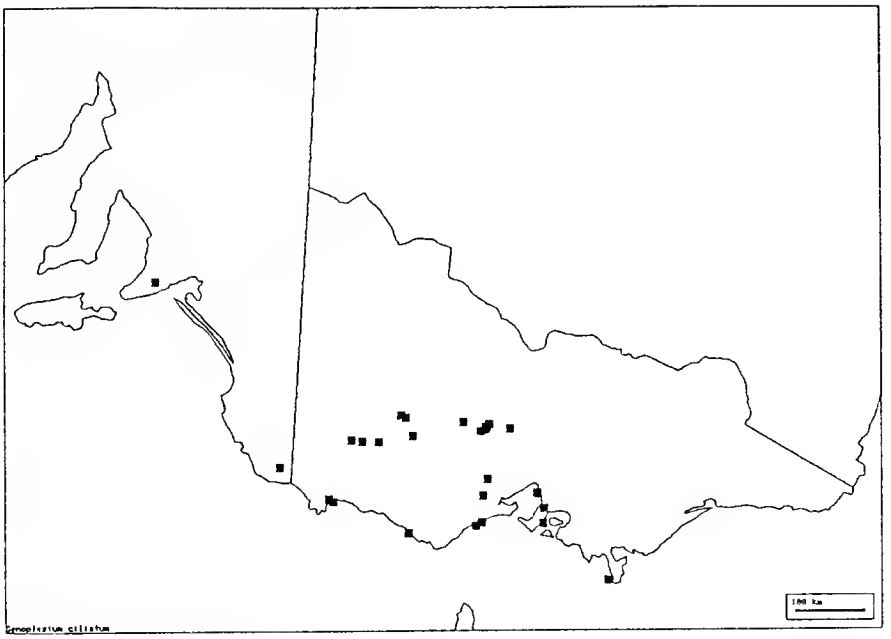

Fig. 3. Distribution of *Genoplesium ciliatum.*

their colour or tepal orientation. The species is likened by Ewart and Rees to *Prasophyllum woollsii* F.Muell. (= *Genoplesium woollsii*) a predominantly dark reddish brown flowered species from the central coast and ranges of New South Wales. The two species have little in common and Ewart and Rees appear to have followed Bentham (1873) in his placement of *Prasophyllum woollsii* close to *P. archeri* and *P. intricatum* Benth., both members of the *Genoplesium archeri* complex.

The County of Talbot is in the central goldfields of Victoria. It is a roughly circular region bounded by Eddington in the north, Creswick in the south, Lexton in the west and Taradale in the east. The location of Green Valley however is somewhat uncertain. A notation on the holotype sheet in J.H. Willis's handwriting says 'Green Valley, NE of Newstead'. Green Valley may be a corruption of the modern locality of Green Gully which is approximately 4 km. east of Newstead.

NOTES

Genoplesium ciliatum has as its closest congener *G. sagittiferum* (Rupp) D.L. Jones & M.A. Clem. Both species have a similar flower colouration but plants of *G. sagittiferum* are much more robust and have larger perianth segments (dorsal sepal to 6.2 x 2.6 mm, lateral sepals to 7.2 x 1.2 mm, petals to 5 x 1.4 mm, labellum to 4.5 x 2.3 mm) and the labellum cilia are more numerous and longer. Jones (in Walsh & Entwisle, 1994) recorded *G. sagittiferum* for Victoria based on specimens to the south-east and south-west of Melbourne. Subsequent research by the first author has shown that these specimens are of *G. ciliatum* and consequently *G. sagittiferum* should be deleted from the Victorian flora.

Nicholls (1932) described *Prasophyllum archeri* var. *deirdrae*, from a single specimen which is illustrated in colour in Nicholls 1969, plate 159, figs c, j & m. The collection was apparently made when the plant was immature and the buds were allowed to develop to the flowering stage by the stem being placed in water. This may account to some extent for the unusual pale yellowish colour of the flowers and their pronounced drooping habit. This taxon is conspecific with *G. ciliatum*, having most of its morphological features (differing only in the colouration and drooping flowers) and originating within the distribution of the species.

CONSERVATION STATUS

Recorded for a number of biological reserves and probably secure in Victoria; endangered in S.A. due to habitat alienation. Recommend Briggs and Leigh coding of 3RCa.

SELECTED SPECIMENS (25 examined)

VICTORIA: Cheltenham, Mar. 1928, *Nicholls* (MEL); Aireys Inlet, 1929, Sutherland (MEL); Green Gully, July 1932, *Nicholls & Bishop* (MEL); Green Gully, near Newstead, Apr. 1933, *Nicholls* (MEL); Ararat, 1 June 1933, *Nicholls* (MEL); Muekleford, Mar. 1935, *Nicholls* (MEL); Maryborough, 11 June 1939, *Chisholm* (MEL); Brisbane Ranges, 29 Mar. 1990, *Foster* (CBG); Langwarrin, 19 Mar. 1992, *Glare* (CBG); Anglesea, 19 Mar. 1992. *Foster* (CBG); Crib Point, 5 Mar. 1992, *Glare* (CBG); Port Campbell, May 1995, *Rowney* (CBG).

SOUTH AUSTRALIA: Mt Compass, 3 May 1914, Rogers (AD, MEL); Nangkita Gravel Reserve, 2 Apr. 1992, Bates 27912 (AD, CBG); *ibid*, 25 Mar. 1995, Murfet 2172 (CBG).

PRELIMINARY KEY TO THE *GENOPLESIUM ARCHERI* COMPLEX

1 Petals ciliate ..... ***Genoplesium morinum***
1: Petals usually glabrous 2

2 Flowers predominantly green or yellowish green with a contrasting pale reddish labellum 3
2: Flowers predominantly reddish or purple, sometimes with a few green markings 4

3 Sepals 4-5 mm long; SA and Victoria ..... ***Genoplesium ciliatum***
3: Sepals 6-7 mm long, central tablelands of NSW ..... ***Genoplesium sagittiferum***

4 Anterior lobe of column wings denticulate or papillose but not with elongated trichomes 5
4: Anterior lobe of column wings with conspicuous elongated trichomes 6

5 Plant 20-40 cm tall; flowers in an open spike, light reddish with acontrasting reddish black labellum; lowland north Queensland only purplish red; sub-alpine N.S.W. and A.C.T. only ..... ***Genoplesium turfosum***

6 Flowers manifestly nodding; lateral sepals porrect or deflexed ..... ***Genoplesium archeri***
6: Flowers semi-nodding or porrect; lateral sepals usually erect 7

7 Plant 13-21 cm tall; flowers in a dense spike; cilia on labellum margins mostly >0.5 mm long; montane to sub-alpine north-eastern Victoria only ..... ***Genoplesium arrectum***
7: Plant 25-40 cm tall; flowers in a moderately crowded spike; cilia on labellum margins mostly <0.5 mm long; central Queensland tablelands only ..... ***Genoplesium validum***

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New taxa and some new nomenclature in *Eucalyptus*

M.I.H. Brooker & A.V. Slee

Centre for Plant Biodiversity Research, G.P.O. Box 1600, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT

The coastal form of manna gum is established in the new combination, *Eucalyptus viminalis* subsp. *pryoriana*. The mallee box, *Eucalyptus wimmerensis* from western Victoria, is changed in rank to a subspecies of *E. viridis* and a recently discovered red box from far eastern Victoria, *E. polyanthemos* subsp. *longior*, is described. The mallee from north-western Victoria, incorrectly known as *E. anceps* (type = *E. rugosa*), which occurs chiefly in South and Western Australia is published as *E. phenax*. Notes on *E. willisii* subsp. *falciformis* and its extended distribution are given. Problems resulting from the inadequately documented distribution and variation in *E. aromaphloia* Pryor & Willis are discussed. Illustrations of buds, fruits and leaves and a distribution map are provided for *E. polyanthemos* subsp. *longior* and *E. phenax*.

Introduction

In the course of our field and herbarium studies in preparation of the *Flora of Victoria* treatment of the genus *Eucalyptus*, we have found that existing classifications are not always adequate to accommodate various species. Hence we erect eight new series and one new subseries.

We have found some taxonomic groups particularly intractable. These include the peppermints, boxes and the so-called scent barks (*E. aromaphloia* group) which are discussed at length. In addition, we publish a new red box, *E. polyanthemos* subsp. *longior*, revise the status of *E. wimmerensis* and *E. pryoriana* and provide a valid name, *E. phenax*, for the widespread mallee, formerly and incorrectly known as *E. anceps* (R. Br. ex Maiden) Blakely. The order of presentation begins with notes on the peppermints and the *E. aromaphloia* group followed by the various formal taxonomic treatments in the order they appear in the forthcoming *Flora of Victoria*.

Taxonomy

1. *Eucalyptus* ser. *Radiatae* Chippendale

Eucalyptus willisii Ladiges, Humphries & Brooker subsp. *falciformis* Newnham, Ladiges & Whiffin, *Austr. J. Bot.* 31: 583 (1986). TYPE: Intersection of Taylor Rd and Burrong Shortcut, W of Mt. Victory, Grampian Ranges, 37°10'4''S, 142°14'40''E, 12 June 1985, *M. Newnham 64* (HOLOTYPE: MEL 673439; ISOTYPES: CANB, NSW).

The identities of the peppermint eucalypts of Victoria have long been in contention. Blakely (1934) recognised three species, viz., *E. lindleyana* DC (syn. *E. elata* Dehnh.), *E. robertsonii* (syn. *E. radiata* Sieber ex Spreng. subsp. *robertsonii* (Blakely) Johnson & Blaxell), and *E. dives* Schauer. Blakely listed only New South Wales localities for typical *E. radiata*.

Willis (1973) considered that *E. radiata* was so polymorphic that division of the species was not warranted. Hence he referred the narrow-leaved peppermints to *E. radiata*, apart from the distinctive *E. elata* and the 'near coastal' peppermints occurring from ?Orbost ('W' in the distribution data) west presumably to South Australia ('DE' in the distribution data). He attributed this southern taxon to *E. nitida*, a Tasmanian peppermint as to type. Willis distinguished *radiata* from *nitida* in his key by the angle of

divergence of the side veins, i.e. >20° compared with almost longitudinal respectively. We do not suport this distinction. He did not state under his treatment of *E. nitida* if the distribution 'E' was intended to include the Grampian Ranges.

Ladiges, Humphries & Brooker (1983) investigated the southern Victorian peppermints and concluded that they were a taxon distinct from *E. nitida*. Consequently, they erected a new species, *E. willisii* (type from Near Mt Oberon, Wilson's Promontory). Later, Newnham, Ladiges & Whiffin (1986) distinguished the Grampians populations of *E. willisii* as a separate but related taxon, subsp. *falciformis*.

Our own investigations and those of T. Whiffin and D. Rankin of La Trobe University (*pers. comm.*) indicate that the coastal peppermints west of Melbourne, extending into the south-east of South Australia, and those of the Grampian Ranges are the same taxon, i.e. subsp. *falciformis*. They have larger, coarser juvenile and adult leaves and larger buds and fruit than the typical subspecies. There are no sudden morphological and geographical distinctions between the subspecies. Populations west of Gisborne may be interpreted as intergrades between the two subspecies and possibly influenced genetically by the contiguous *E. radiata*.

Johnson & Hill (1990) segregated a further peppermint species, the glaucous *E. croajingolensis*. This occurs mostly in far eastern Victoria but extends as far west as Mt. Useful and possibly near Lake Mountain, from subcoastal hills north and east to far south-eastern New South Wales. North and west of this distribution, i.e. inland from the Great Dividing Range in eastern Victoria but widespread in the central highlands and extending to the Wombat State Forest north-west of Melbourne and Otway Range is a non-glaucous, narrow, thin-leaved peppermint species that appears to be conspecific with the species that occurs widely on the eastern side of the tableland of south-eastern New South Wales.

From field examination, we consider this latter taxon to be typical *E. radiata*. The populations in Victoria are not conspicuously variable although the adult leaves may be dull or slightly glossy. There is a 'central' area from Mt Buffalo east to Benambra where the seedling leaves are narrower than elsewhere. *E. radiata* subsp. *robertsonii*, which is relatively abundant in New South Wales from the Snowy Mountains northwards in the high country, is a tall, narrow-leaved forest tree with glaucous buds and fruits. We have not found this subspecies in Victoria after extensive field and herbarium studies.

We conclude that the peppermints have not undergone distinctive speciation and accept that many specimens will not be ascribable to any of the above names.

2. *Eucalyptus* ser. *Acaciiformes* L.A.S. Johnson ex Brooker & Slee, *ser. nov.*
Extracodical *E.* ser. *Acaciiformes* Johnson (unpubl.)

Ad *Eucalyptum* sectionem *Macrantheras* pertinens, habitu arboreo, cortice aspero, inflorescentiis 7-floribus, foliis plantularum subsessilibus vel petiolatis, et fructibus disco leviter ascendenti distinguitur.

TYPUS: *Eucalyptus acaciiformis* Deane & Maiden

Eucalyptus aromaphloia Pryor and Willis, *Vic. Nat.*, 71: 125 (1954). TYPE: At 113 mile post on the Great Western Highway, Victoria (between Buangor and Mt Langi-Ghiran in Ararat district), and approximately at the centre of the species' range, 20 August 1954, *L.D. Pryor & J.& J.H. Willis* (MEL, Herb. Dept. Interior, NSW, BRI, K); PARATYPE: from Eastern Hill, Creswick, January 1, 1946, *J.H. Willis* (MEL).

In the protologue of *E. aromaphloia* the authors discussed the problem in relating the name *E. huberiana* Naudin (TYPE: Cap d'Antibes, France, published 1891) to natural populations. It was concluded that some Victorian populations ascribed to *huberiana* were hybrids of *E. viminalis* with an un-named species. This other parent of the so-called hybrid was published as *E. aromaphloia* Pryor & Willis in 1954. The new species was considered to have an extensive distribution in western Victoria and to cross into South Australia. The southern, more coastal forms of *huberiana* were later (1980)

included in *E. viminalis* subsp. *cygnetensis* by C.D.Boomsma (*type*: Cygnet River, Kangaroo Island, South Australia).

Willis (1973) and Costermans (1981) extended the distribution of *E. aromaphloia* to East Gippsland. Chappill (1986) made a comprehensive study of the major *aromaphloia* forms across Victoria plus *E. corticosa* L.A.S.Johnson from the Rylstone area of central western New South Wales. Chappill concluded that there were four taxonomic entities involved, viz. *E. corticosa* s.s., Little Desert and western Grampians populations of *E. aromaphloia*, the typical form occurring from the Mt. William Range in the Grampians east to the Brisbane Ranges, and another wide-ranging form east of Melbourne.

Populations 'in the broader concept of *E. aromaphloia*' from east of Erica to the Eden area of far south-eastern New South Wales were segregated as a new species, *E. ignorabilis*, by Johnson & Hill (1991). The western limit for this species which, has dull green adult leaves, according to the protologue and our own observations, was given as 'around Morwell'. There is a problem in the distribution for the species as the map shows two sites clearly west of the cited area. These western populations, which we interpret to occur from Woori Yallock south-east to Driffield, have conspicuously glossy green adult leaves, ovate juvenile leaves and cannot be *E. ignorabilis*. They have been published as *E. fulgens* by Rule (1996 see page 136 of this volume). Other problems in the overall *aromaphloia* taxonomy have been brought to our attention by this author

Recent fieldwork by ourselves indicates that typical *E. aromaphloia* is scattered and relatively widespread compared with other taxa in the group. It may be diagnosed by:

- bark - rough to small branches, thick, hard, becoming deeply furrowed like ironbark;
- juvenile leaves - elliptical to narrowly oblong, slightly crenulate, dull, bluish green; sessile to very shortly petiolate, opposite for many pairs;
- adult leaves - slightly glossy, green to bluish green;
- inflorescences - 7-flowered.

It occurs in central and western Victoria from the Mt. William Range in the eastern Grampians north-east to the Fryers Range State Forest, south-east to Anglesea and south to Moonlight Head. West of this area, including part of the Grampian Ranges and Little Desert and south to near Cavendish, the juvenile leaves are ± linear. This form, worthy of recognition as a subspecies of *E. aromaphloia* and treated elsewhere in this volume as *E. sabulosa* K.Rule, (see page 138), is never coastal. *E. viminalis* subsp. *cygnetensis* maybe confused with it in the south-west of the State but differs in the typical *viminalis* juvenile leaves, i.e. sessile usually amplexicaul, green, lanceolate, and remaining opposite for many leaf pairs. The fruit of *viminalis* are larger, with a more prominent ascending disc which varies from flattish to slightly ascending in both taxa of *E. aromaphloia*.

A further form, restricted to the Mt Richmond area in the far south-west of the State, was rejected by Chappill in her study which was specifically on *E. aromaphloia* and closely related taxa. This form was considered by her to be *E. viminalis* subsp. *cygnetensis*. It is notable for the rough bark, yellow branchlets, and very glossy, green, adult and juvenile leaves. It is published elsewhere in this volume as *E. splendens* K.Rule (see page 140) and differs most conspicuously from the *viminalis* group in the seedling leaves which are soon very shortly petiolate and taper to the base and are not amplexicaul.

Pryor & Willis's (1954) surmise that *E. aromaphloia* occurs in South Australia has not been proved. Unsubstantiated sitings are probably *E. viminalis* subsp. *cygnetensis*.

3. *Eucalyptus* ser. *Rufispermae* Maiden
Eucalyptus phenax Brooker & Slee, *sp. nov.*
Eucalyptus anceps auct. pl. non (R.Br. ex Maiden) Blakely (1934).

Eucalypto conglobatae (R.Br. ex Benth.) Maiden affinis a qua constanter habitu fruti-

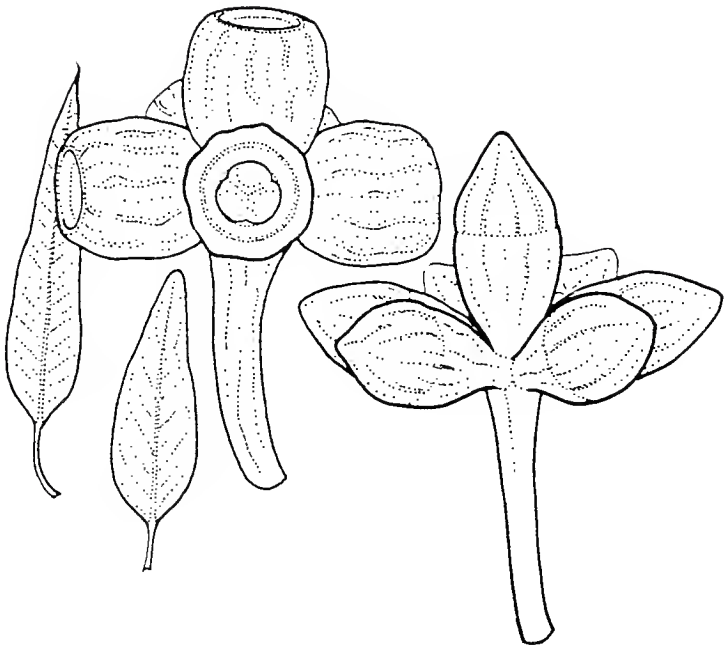

Fig. 1. Buds, fruits and leaves of *Eucalyptus phenax*.

coso, foliis lanceolatis, praesentia pedunculorum, basi alabastrorum decrescentibus et fructibus angustioribus longioribus quam latioribus differt.

TYPE: South Australia, 12.7 km from Duke's Highway towards Pinnaroo, 35°17'27''S, 139°37'30''E, 26 Jan. 1995, *D. Nicolle 1212, R. Nicolle & M.I.H. Brooker* (HOLOTYPUS: AD; ISOTYPES: CANB, MEL, NSW, PERTH).

With affinity to *Eucalyptus conglobata* from which it differs by the consistent mallee habit, lanceolate leaves, presence of peduncles, the tapering base of the buds, and the narrower fruit which are longer than wide. (Fig. 1)

DISTRIBUTION

Western Australia from near Bolgart, north-east of Perth eastwards and southwards although largely subcoastal, but not known for certain along the southern Nullarbor Plain; South Australia on Eyre Peninsula, Yorke Peninsula and south-east of Adelaide except the southern part of Fleurieu Peninsula, extending into Victoria in the Sunset Country and Big and Little Deserts. (Fig. 2)

ETYMOLOGY

From the Greek noun *phenax*, impostor, in reference to the species' long and misleading tenancy of the name *anceps*.

NOTES

Eucalyptus phenax has been incorrectly known as *E. anceps* until the last few years when it was recognised that the type of *E. anceps,* collected by Robert Brown on Kangaroo Island in 1802, was *E. rugosa* (the senior author and P. Lang, *pers. comm.*). The name *rugosa* (*E.* ser. *Torquatae*) has been correctly applied by most collectors and

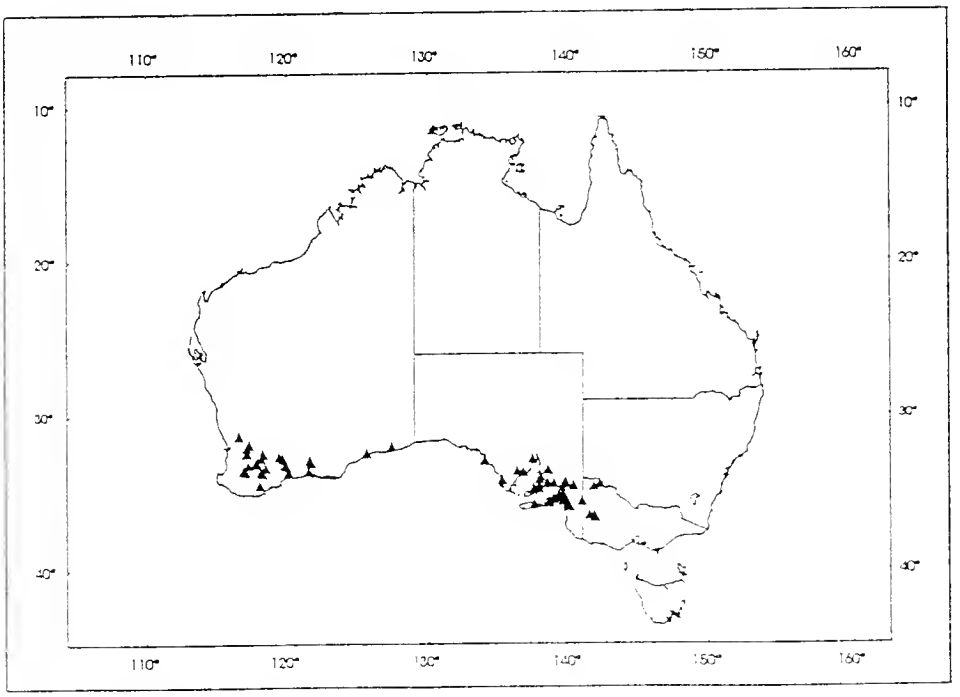

Fig. 2. Distribution of *Eucalyptus phenax*.

taxonomists.

The type of *E. anceps* (BM, CANB, E, K, MEL, NSW) is a sprig with adult leaves and apparently mature flower buds. The peduncles are flat, wide and stout and the buds have opercula narrower than the hypanthium. It is unmistakeably *E. rugosa* (also publ. 1934), yet the name *anceps* has invariably been applied to a comparatively unrelated mallee.

Eucalyptus phenax belongs to the large series *Rufispermae* in which speciation is often not distinct. It is closely related to *E. conglobata, E. pileata* and *E. dumosa,* but its long time acceptance as a taxon, albeit sometimes tentatively, suggests that it should have the same rank along with the three species above.

One of the confusing issues concerning *E.* '*anceps*' (now *E. phenax*) is that its common name is Kangaroo Island Mallee. However, its actual occurrence on the island has been in contention, and in recent literature, '*anceps*' has been somewhat arbitrarily treated.

Boomsma (1981) included Kangaroo Island in his distribution for the species. Jessop and Tolkien (1986), on the other hand, subsumed '*anceps*' in *E. conglobata* on the advice of P. Lang whose concepts (then) of taxonomic rank were at odds with fellow workers. Populations which Jessop and Tolkein attributed to *E. conglobata* occur at the eastern end of the island, although there is no indication as to whether they considered these populations to be *E conglobata* s.s. only, or whether they consisted of *E. conglobata* s.s. plus *E.* '*anceps*'. Brooker & Kleinig (1983) included '*E. anceps*' on the island according to the distribution map and the common name, but excluded it later (1990) when they devoted a key specifically to the island's eucalypts.

In the most recent study of the eucalypts of Kangaroo Island, D. Nicolle (unpubl. 1994) considered that the mallees on the island most commonly attributed to '*anceps*' were a separate, unrecognised taxon which he referred to as '*E.* affinity *conglobata*'. He does not recognise the occurrence of *E. conglobata* s.s. on the island. The distribution of this un-named taxon is given as 'north-eastern Kangaroo Island and Waitpinga to

Goolwa', these latter, fairly restricted sites being on the mainland opposite. Nicolle distinguishes the widespread mainland species, *E. phenax*, from both of the related taxa, viz. *E. conglobata* and *E.* affinity *conglobata.*

SELECTION OF SPECIMENS EXAMINED

WESTERN AUSTRALIA: 30 km from Tammin on York road, 15 Sep. 1982, *M.I.H. Brooker 7630* (CANB); opposite Stennet's Lake, 26 Feb. 1985, *M.I.H. Brooker 9120* (CANB); Mosquito Hill, Bolgart East Road, 3 Sep. 1987, *M.I.H. Brooker 9753* (CANB); 21.8 km south of Lake Grace town on Pingrup road, 23 Oct. 1983, *K. Hill 329* (CANB, NSW, PERTH); 22.4 km NW of Parmango Road on Clyde Rock Track, *Margaret Johnston 8* (CANB).

SOUTH AUSTRALIA: Gum Flat near Cleve, 16 May 1973, *D. Boland 1521* (CANB); south-east of Mt. Hope, Eyre Peninsula, 6 Dec. 1972, *M.I.H. Brooker 3865* (AD, CANB, MEL, NSW, PERTH); Between Waikerie and Blanchetown, 3 Apr. 1975, *M.I.H. Brooker 4906* (AD, CANB); Murray Bridge, 6 Jan. 1907, *R.H. Cambage & J.H. Maiden s.n.* (CANB 6474); south-east corner of section 110, Hd. of Wiltunga, 4 Feb. 1966, *B. Copley 8* (AD, CANB); about 10 km WSW of Coomandook, 20 May 1973, *M.D. Crisp 476* (AD, CANB); 15 km south-west of Kapunda, 1 Jul. 1973, *M.D. Crisp 494* (AD, CANB); 25 km east of Tailem Bend on Pinnaroo road, 3 Sep. 1985, *N.N. Donner 10635* (AD, CANB); Willaston, 5 Sep. 1967, *D.N. Kraehenbuhl 2749* (AD, CANB); Koppio, Eyre Peninsula, 28 Dec. 1977, *L.D. Williams 9718* (CANB); Yorke Peninsula, ca. ½ km south of Bluff, 13 Sep. 1974, *J.Z. Weber 4111* (AD, CANB).

VICTORIA: Wyperfeld National Park. Extreme E end of Ginap Track S.E. of Yallum Dune, 12 Nov. 1968, *A.C. Beauglehole 29537* (MEL, CANB); 20.9 km S of Mildura on Ouyen road, 5 Sep. 1989, *M.I.H. Brooker 10264* (CANB); 14.6 km E of junction of Werrimul road and north boundary track of Sunset Country, 11 Oct. 1989, *M.I.H. Brooker 10321* (CANB); 7.3 km south of Murray Valley Hwy, S of L. Kramer, 11 Oct. 1989, M.I.H. Brooker *10325* (CANB); Little Desert National Park. Junction of Kiata South Road-Campground Road, 26 Sep. 1990, *G. Cornwall,* Ref. L.D. 1/90 (CANB, MEL).

4. *Eucalyptus* ser. *Orbiculares* Brooker & Slee, *ser. nov.*
Eucalyptus subser. *Perfoliatae* Blakely, *Key Eucs* 150 (1934).

Ad *Eucalyptum* sectionem *Macrantheras* pertinens, foliis juvenilibus sessilis oppositis per nodos multos orbicularibus glaucis, foliis adultis hebetibus et inflorescentiis 3-floribus distinguitur.

TYPE: *Eucalyptus perriniana* F.Muell. ex Rodway

5. *Eucalyptus* ser. *Bridgesianae* Brooker & Slee, *ser. nov.*

Ad *Eucalyptum* sectionem *Macrantheras* pertinens foliis juvenilibus sessilis oppositis vel suboppositis per nodos multos ovatis crenulatis et inflorescentiis 7-floribus distinguitur.

TYPUS: *Eucalyptus bridgesiana* R.Baker

6. *Eucalyptus* ser. *Viminales* Blakely

Eucalyptus viminalis subsp. ***pryoriana*** (L.A.S.Johnson) Brooker & Slee, *comb. et stat. nov.*
Eucalyptus pryoriana L.A.S.Johnson, *Contr. New South Wales Natl Herb.* 3: 115 (1962), basionym. *E. viminalis* var. *racemosa* F.Muell. ex Blakely, *Key Eucalypts* 162 (1934). TYPE: Port Phillip, Vic., Feb. 1880, *?F. Mueller* (LECTOTYPE: NSW *fide* L.A.S. Johnson, *loc. cit.*).

The manna gums, *E. viminalis sens. lat.*, are widely distributed in well-watered parts of south-eastern Australia. The typical mainland form is notable for its occurrence along valley bottoms and riversides in hilly or mountainous country where it is an erect, often tall tree with smooth bark except at the very base. There are usually prominent ribbons of imperfectly decorticated bark hanging in the crowns. Buds of the inflorescences are in 3s. The juvenile leaves are green and remain sessile and opposite for many pairs.

There are two currently recognised, non-typical infraspecific taxa, both of coastal and subcoastal plains in Victoria, apart from an extension into the southern Grampians. One is *E. viminalis* subsp. *cygnetensis* which is a completely rough-barked woodland

tree with buds mostly in 7s. It occurs from west of Melbourne to Kangaroo island and southern Eyre Peninsula in South Australia. Subspecies *pryoriana* occupies infertile coastal sandy soils from Bellarine Peninsula east as far as Lake Tyers. It is a small tree with rough bark and buds in 3s. It occurs commonly with *Banksia marginata* and *Leptospermum laevigatum*, also with *E. willisii, E. bosistoana, E. baueriana* and *E. globoidea*. Neither of these subspecies of *E. viminalis* is completely distinctive and *cygnetensis*, in particular, may occur in populations in which the number of buds per inflorescence is variable.

7. *Eucalyptus* ser. *Neglectae* Johnson ex Brooker & Slee, *ser. nov.*
Extracodical *Eucalyptus* ser. *Neglectae* L.A.S.Johnson (unpubl.)

Ad *Eucalyptum* sectionem *Macrantheras* pertinens habitu arboreo, cortice aspero, foliis arboris summae juvenilibus adultisque, inflorescentiis 7-15-floribus, pedunculis brevissimis et alabastris fructibusque sessilibus, congestis et glaucis distinguitur.

TYPUS: *Eucalyptus neglecta* Maiden

A monotypic series.

8. *Eucalyptus* ser. *Crenulatae* Brooker & Slee, *ser. nov.*

Ad *Eucalyptum* sectionem *Macrantheras* pertinens, habitu arboreo, cortice aspero, foliis arboris summae omnino juvenilibus ovatis, primo glaucis postremo viridibus, inflorescentiis 7-11-floribus, alabastris pedicellatis glaucis et operculo rostrato distinguitur.

TYPE: *Eucalyptus crenulata* Blakely & Debeuzeville

A monotypic series.

9. *Eucalyptus* ser. *Kitsonianae* L.A.S.Johnson ex Brooker & Slee, *ser. nov.*
Extracodical *E.* ser. *Kitsonianae* L.A.S.Johnson (unpubl.)

Ad *Eucalyptum* sectionem *Macrantheras* pertinens, habitu arboreo vel fruticoso, cortice laevi, foliis juvenilibus sessilibus oppositis per nodos multos latis, foliis adultis magnis, inflorescentiis 7-floribus, prominenter bracteatis distinguitur.

TYPE: *Eucalyptus kitsoniana* Maiden

A monotypic series.

10. *Eucalyptus* ser. *Subbuxeales* Blakely

Eucalyptus viridis R. Baker subsp. ***wimmerensis*** (Rule) Brooker & Slee, *comb. et stat. nov. Eucalyptus wimmerensis* Rule, *Muelleria* 7: 193 (1990), basionym. TYPE: Victoria, Lawloit Range on the Western Highway between Nhill and Kaniva, 36°24'S, 141°31'E, 27 Dec. 1964, *J.H. Willis s.n.* (MEL).

The box eucalypts are a vexing problem taxonomically. Occurring widely in all mainland States, they has never been a satisfactory comprehensive treatment. Simplistically, not they may be considered to consist of desert species, e.g. *E. intertexta*, tropical species, e.g. *E. tectifica*, floodplain species, e.g. *E. microtheca*, and eastern species which comprise a very large array of taxonomic series. These may be divided into two major groups, one in which the outer operculum is shed during bud development and a second in which the outer operculum is held until flowering. In this latter group are the mallee boxes which consist of about six species ranging from Eyre Peninsula through Victoria and New South Wales to south-eastern Queensland.

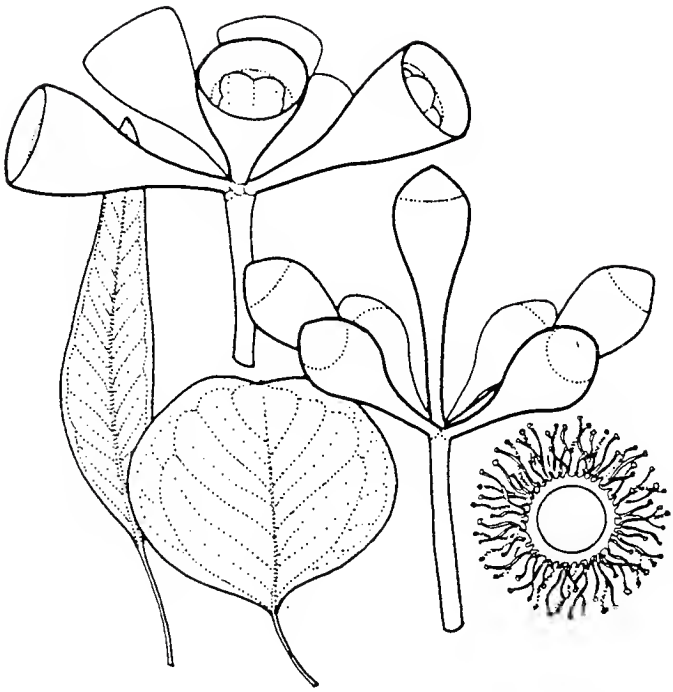

Fig 3. Buds, fruits, shed androecium and leaves of *Eucalyptus polyanthemos* subsp. *longior*.

Eucalyptus. viridis is the most widespread of these mallee boxes, occurring in the Flinders Range of South Australia, across western and central Victoria, the western plains and slopes of New South Wales and scattered in south-eastern Queensland. Willis (1973) considered a population in the Lawloit Range between Nhill and Kaniva, and which he retained in this species, to be aberrant because of its broader leaves and larger fruit.

Rule (1990), in a study that included both forms of *E. viridis* plus *E. odorata* and *E. polybractea*, concluded that the Lawloit Range form was more extensive in distribution than indicated by Willis and constituted a new species. The grounds for his decision were varied but were largely differences in degree, e.g. among these four taxa, the sides of the fruit were given as varying from slightly angled to faintly ribbed to smooth. The bark character for *wimmerensis* is given as 'smooth or rarely basal, fibrous' and for *viridis* as 'fibrous stocking, confined to lower stem'. It is easy though scarcely of much scientific merit to dwell on selected comparisons like these, but we believe that stronger, discrete differences should be the criteria for species. Hence we have decided on subspecies rank for *wimmerensis*.

11. *Eucalyptus* ser. *Heterophloiae* Blakely

Eucalyptus polyanthemos subsp. ***longior*** Brooker & Slee, *subsp. nov.*

a subspecie typica foliis adultis longioribus lanceolatis differt.

TYPE: Victoria. 4.6 km along Ostler's Gap Road from Waygara Track Junction; N of Waygara, 37°42'S, 148°20'E, 17 Nov. 1993, *M.I.H. Brooker 11637 & A. Slee* (HOLOTYPE: CANB; ISOTYPES: AD, MEL, NSW).

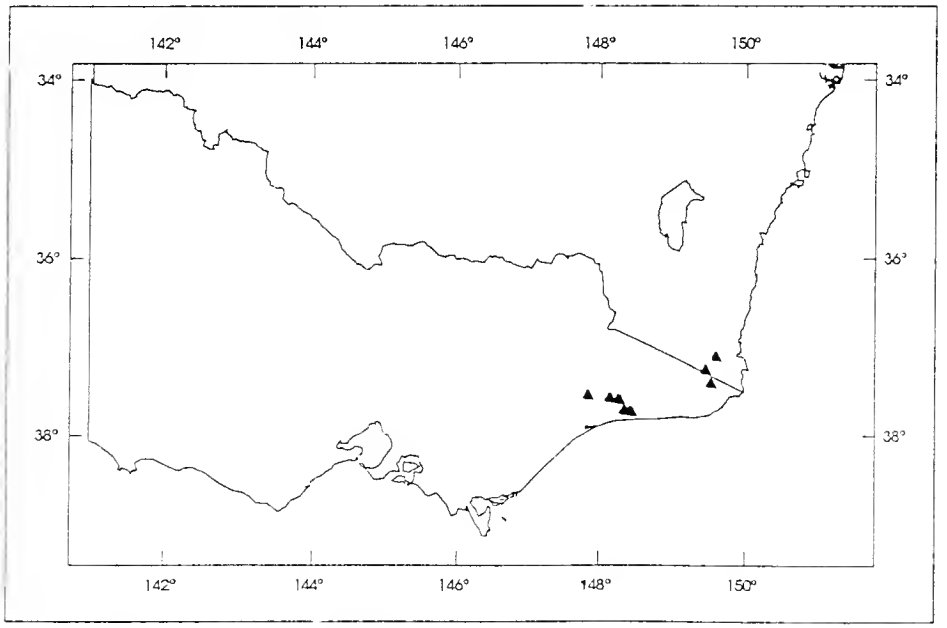

Fig. 4. Distribution of *Eucalyptus polyanthemos* subsp. *longior*.

It differs from the typical subspecies by the lanceolate adult leaves (to 14 x 3 cm) of the mature crown. (Fig. 3)

DISTRIBUTION

This subspecies occurs in low hills of far eastern Victoria from south of Omeo east to Wangarabell and north to Nungatta in far south-eastern New South Wales (Fig. 4).

ETYMOLOGY

From the Latin, *longior,* longer, in reference to the leaves of the new subspecies.

NOTES

Distinctive variants in *E. polyanthemos* have long been recognised. Johnson & Hill (1990) treated the form in southern New South Wales and parts of Victoria in their publication of *E. polyanthemos* subsp. *vestita* which they distinguished from the typical subspecies by the amount of persistent rough bark. Our recent field work revealed the existence of a further form of red box in far eastern Victoria and which extends into far south-eastern New South Wales. It is fully rough-barked like subsp. *vestita* but has lanceolate leaves.

The region in which the new subspecies occurs appears to have been poorly collected for eucalypts as few specimens of this taxon are in herbaria, apart from the early collection of the senior author cited below and some by J.D. Briggs in CANB.

Populations of subsp. *longior* are found within close proximity to those of subsp. *vestita.* They appear to diverge most conspicuously in the shape of the adult leaves, hence the specific epithet. Both subspecies are distinguished from the related *E. baueriana* by their dull, not glossy, leaves.

A further character which will be interesting to investigate is the nature of the androecium. At the type locality at the time of collection (November), the trees were in full flower. The spent androecium was shed intact as a ring comprising the stemonophore and the stamens. These yellowish rings were conspicuous as they were strewn in large numbers under the trees. This phenomenon has also been seen in the typical subspecies although it does not seem to have been reported before in this or any

other eastern species. Shedding of the whole androecium is very rare in *Eucalyptus* but may be seen in the entirely unrelated, *E. macrandra,* a Western Australian endemic (Brooker & Kleinig 1990).

OTHER SPECIMENS EXAMINED

VICTORIA: Reeve Road, west of Orbost, 16 Jan. 1980, *M.I.H. Brooker 6813* (CANB, NSW, PERTH); Mottle Range road, north end, WNW of Orbost, .16 Jan. 1980, *M.I.H. Brooker 6821* (CANB, MEL, NSW); type locality (coppice), *17 Nov.* 1993, *M.I.H. Brooker 11638 & A. Slee*, (AD, CANB, BRI, MEL, NSW); Marimingo Hill, north of Genoa, 4 Mar. 1994, *M.I.H. Brooker 11720* (BRI, CANB, MEL, NSW); ca. 60 km SE of Omeo on the Omeo Highway, 10 Feb. 1978, *J.D. Briggs 111* (CANB); 15.6 miles from Buchan towards Orbost, 17 Sep. 1975, *M.I.H. Brooker 4956* (AD, BRI, CANB, MEL, NSW).

NEW SOUTH WALES: Nungatta North Station, 2.8 km south of Blackbird Creek on track to Nungatta South, 23 Jan. 1989, *J.D. Briggs 2515* (CANB); 0.3 km west of Pericoe, 11 Nov. 1989, *K. Hill 3644 & R. Makinson* (CANB, MEL, NSW).

12. *Eucalyptus* ser. *Contiguae* Brooker & Slee, *ser. nov.*

Ad *Eucalyptum* sectionem *Renantheras* pertinens, habitu fruticoso vel rare arbuscula, cortice pro parte maxima laevi, foliis viridibus numquam glaucis, inflorescentiis 7-11 floribus, pedunculis brevissimis, alabastris brevibus verrucosis, fructibus sessilibus congestis distinguitur.

TYPUS: *Eucalyptus kybeanensis* Maiden & Cambage

A monotypic series.

13. *Eucalyptus* ser. *Pauciflorae* L.A.S.Johnson ex Brooker & Slee, *ser. nov.*
Extracodical *Eucalyptus* ser. *Pauciflorae* L.A.S. Johnson (unpubl.)

Ad *Eucalyptum* sectionem *Renantheras* pertinens, cortice laevi, foliis plantularum oppositis paucis, juvenilibus non oppositis petiolatis pendulis, adultis nitentibus venis principalibus longitudinalibus distinguitur.

TYPUS: *Eucalyptus pauciflora* Sieber ex Sprcng.

This series comprises the snow gums.

14. *Eucalyptus* ser. *Psathyroxyla* Blakely

Eucalyptus* subser. *Considenianae Brooker & Slee, *subser. nov.*

A subserie typica cortice qui asper est differt.

TYPUS: *Eucalyptus consideniana* Maiden

The erection of this subseries recognises formally the natural affinity of the scribbly gums (subser. *Psathyroxyla*) and the silver-top ashes (subser. *Considenianae*) foreshadowed in the study of the ash group of eucalypts by Brooker (1977).

Acknowledgement
We are grateful to Kevin Thiele for the drawings of the new taxa.

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Muelleria 9: 87–92 (1996)

Notes on *Tetratheca procumbens* Gunn ex Hook.f. (Tremandraceae)

Jeffrey A. Jeanes

National Herbarium of Victoria, Birdwood Ave, South Yarra, 3141, Victoria, Australia

ABSTRACT
A case is made for the recognition of *Tetratheca procumbens* Gunn ex Hook.f. as a species distinct from *Tetratheca pilosa* Labill.. A description of *T. procumbens* is provided, its affinities to *T. pilosa* subsp. *pilosa* and *T. pilosa* subsp. *latifolia* Joy Thomps. are discussed and a key to distinguish the three taxa is supplied. *Tetratheca procumbens* is apparently widespread in Tasmania, but known from only two high altitude locations in Victoria.

Introduction

This study was undertaken to facilitate the preparation of the account of Tremandraceae for the forthcoming *Flora of Victoria* Volume 4. Problems arose in assigning a name to three specimens from the Snowy Plains area of the Eastern Highlands of Victoria. They were clearly very similar to a number of specimens at MEL from both highland and lowland areas of Tasmania. These collections had all been filed as *Tetratheca pilosa* subsp. *pilosa,* following the revision of *Tetratheca* by Thompson (1976). Although *T. pilosa* shows great variation across its range, these small procumbent plants are remarkably distinctive and worthy of re-examination.

Methods

This study is based mostly on the morphological examination of dried herbarium specimens from MEL, CBG, HO and NSW, but additional information has been gained by the observation of living plants growing *in-situ* in Victoria. Measurements given in the description are derived from herbarium material so allowance must be made for possible shrinkage on drying. The relevant type specimens have been examined.

Taxonomic history

The taxon herein referred to as *Tetratheca procumbens* first appeared in the literature as *Tetratheca calva* F.Muell. ex Schuch. var. *pulchella* F.Muell. ex Schuch. (Schuchardt 1853), from high mountainous areas of Tasmania. *Tetratheca procumbens* was described by Hooker in his *Flora Tasmaniae* (Hooker 1855); there he made the statement 'Mr Gunn [collector of the type] considers this a most distinct species'. It was subsequently reduced by Bentham (1863) to *T. pilosa* var. *procumbens* (Hook.f.) Benth. with the comment 'I have considerable doubts whether this elegant Tasmanian variety may not prove permanently distinct'. Bentham (1863) also reduced *T. calva* var. *calva* to synonymy under *T. pilosa* and *T. calva* var. *pulchella* and *T. gunnii* Hook.f. to synonymy under *T. pilosa* var. *procumbens*. Rodway (1903) treated *Tetratheca procumbens* as synonymous with *T. pilosa* var. *calva* Rodway (including *T. gunnii*), this being a new varietal epithet coined by Rodway rather than a new combination reducing *T. calva* to varietal status under *T. pilosa*. Synonymy under *T. pilosa* was ascribed in the first edition of *The Student's Flora of Tasmania* (Curtis 1956) but in the second edition (Curtis & Morris 1975) the taxon was again recognised as a distinct species. Although in her revision of *Tetratheca*, Thompson (1976) reduced *T. procumbens* to synonymy under *T. pilosa* without affording it any formal rank, it is still treated as a distinct species in *A Census of the Vascular Plants of Tasmania* (Buchanan 1995).

Taxonomy

Tetratheca procumbens Gunn ex Hook.f., *Fl. Tasman.* 1: 35, t. 7A (1855).
Tetratheca pilosa Labill. var. *procumbens* (Gunn ex Hook.f.) Benth., *Fl. Austral.* 1: 132 (1863), *nom. illeg.*, the earlier *T. calva* var. *pulchella* was placed in synonymy. TYPE: '(Gunn, 217, 309, 649)' and 'Summit of the Western Mountains, elev. 3800 feet; also near the sea, on heathy plains, at Circular Head etc, Gunn.' SYNTYPES: Gunn 217 (NSW 119678, NSW 119679).

Tetratheca calva F.Muell. ex Schuch. var. *pulchella* F.Muell. ex Schuch., *Syn. Tremandr.* 27 (1853). TYPE: 'In insul. Van Diemen legerunt Gunn et in montibus altis Tasmanniae cl. Müller in Herb. Sonder.' SYNTYPES: MEL 1008363, MEL 1008381, MEL 1008382. *Tetratheca pilosa* Labill. var. *calva* Rodway, *Tasman. fl.* 10 (1903) *p.p.*, as to *T. procumbens* but excluding *T. gunnii*, both cited in synonymy by Rodway.

Procumbent to weakly ascending sub-shrub; taproot sturdy; branches usually many, 5-20(-30) cm long, most emanating from near base of plant; stems terete, often irregularly ridged and appearing quadrangular near nodes, scabrous, virtually glabrous, sometimes with a few short, tubercle-based hairs and glandular hairs, particularly near nodes or on young growth. *Leaves* alternate, subopposite or in irregular whorls of 3, linear to linear-lanceolate, 2-8 mm long, 0.5-1.5(-2) mm wide, straight to arcuate, apex usually acute, mucronate, base truncate, margins mostly revolute to mid-vein, both surfaces usually scabrous, lower surface with dense short, stiff hairs along mid-vein and near margins; petiole to c. 0.5 mm long. *Flowers* solitary in leaf axils; peduncles 1-3 mm long, elongating to c. 4 mm in fruit, glabrous; bracts linear, c. 0.5 mm long, pubescent; sepals ovate, c. 1 mm long, glabrous outside, hairy on inner surface particularly on and near margins, attached inside top of receptacle, deciduous; petals obovate, ovate or elliptical, 3-4.5(-5) mm long, 1-2.5 mm wide, usually widest beyond middle, lilac-pink or white, often with darker longitudinal veins, deciduous; stamens 8, 2-2.5 mm long; filament 0.5-1 mm long; body of anther 1-1.5 mm long, glabrescent; orifice c. 0.2 mm wide; ovary 2-(less often 4-) celled, with a mixture of scattered short fine hairs and glandular hairs; ovules 1 per cell; style slender, to c. 1.5 mm long. *Fruit* obovate to obcordate, 2-4 mm long, 1.5-3 mm wide, with a sparse mixture of simple and glandular-hairs particularly near apex; seeds more or less oblong, 1.5-2.5 mm long, pubescent; appendage with several twists, cream. (Figs. 1 & 2)

FLOWERING PERIOD
October to January depending upon altitude.

DISTRIBUTION AND HABITAT
In Tasmania found mostly at high altitudes but also occurring at lower elevations almost to sea level. In Victoria it is known from only two sites, at about 1100 m and 1420 m above sea level respectively (Fig. 3). The high altitude habitat is generally low heath on moist peaty soils or on *Sphagnum* moss near streams or in rock crevices. At lower altitudes in Tasmania, plants grow in grassy woodlands and shrubby heathlands.

NOTES
Thompson (1976) recognized two subspecies of *Tetratheca pilosa* based mostly on leaf arrangement, leaf shape and ovary indumentum (see key). The type subspecies is widespread in Tasmania, scattered in western Victoria and localised in South Australia mainly in the Mount Lofty Ranges. *Tetratheca pilosa* subsp. *latifolia* is found in northern Tasmania, mainly eastern Victoria and south-eastern New South Wales. The two subspecies are very closely related and occasional specimens, particularly some from Tasmania, are difficult to assign to one or the other subspecies. *Tetratheca procumbens* is relegated by Thompson to synonymy under the type subspecies with a very cursory explanation.

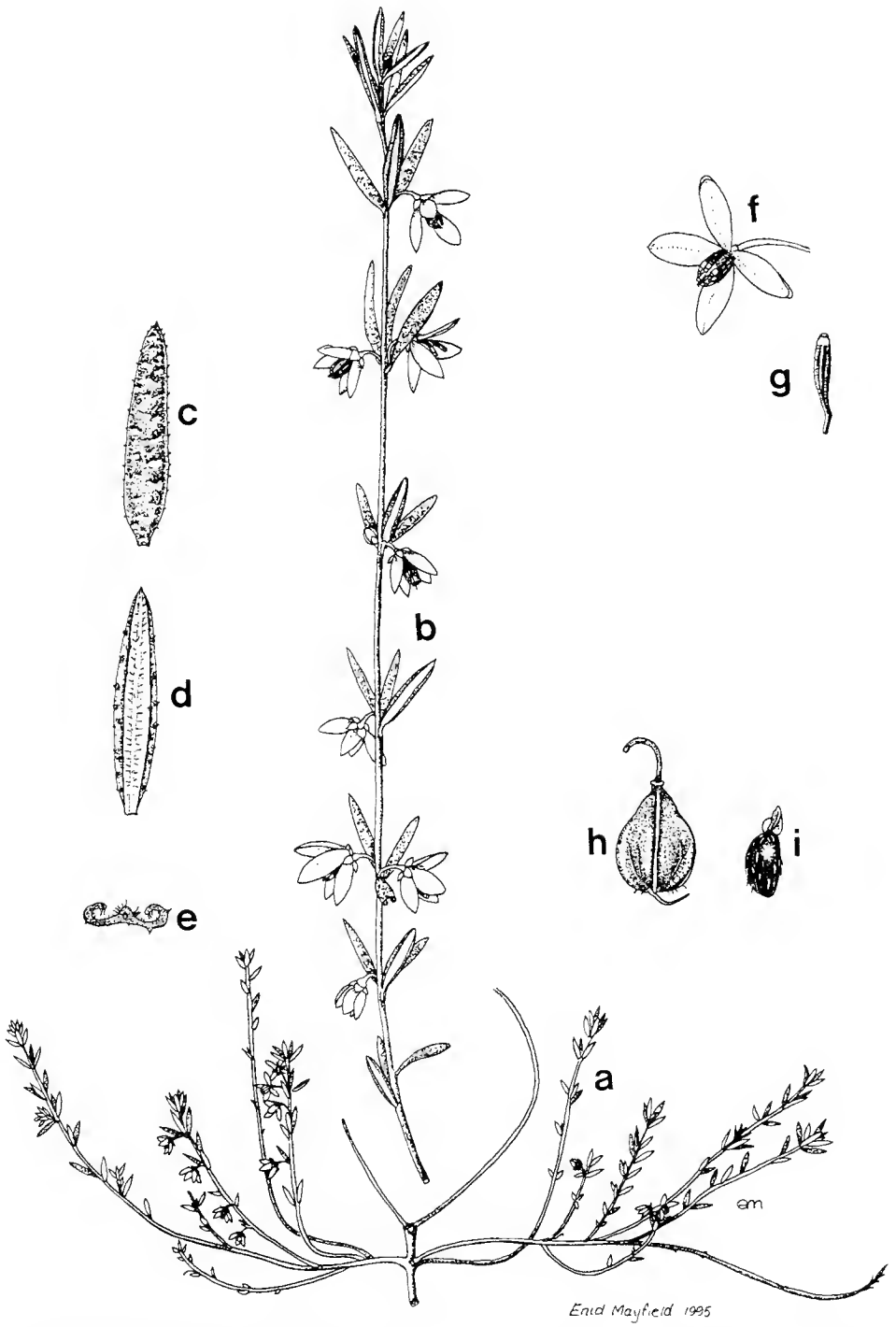

Fig. 1. *Tetratheca procumbens*: a - plant habit x0.5. b - flowering branch x2. c - leaf from above x5. d - leaf from below x5. e - section through leaf x10. f - flower x4. g - stamen x5. h - capsule x4. i - seed x4. a-g drawn from *Beauglehole 43478* (MEL); h, i drawn from *W.H. Archer* (MEL).

Fig. 2. *Tetratheca procumbens*: Plant *in-situ*, Snowy Plains, Victoria.

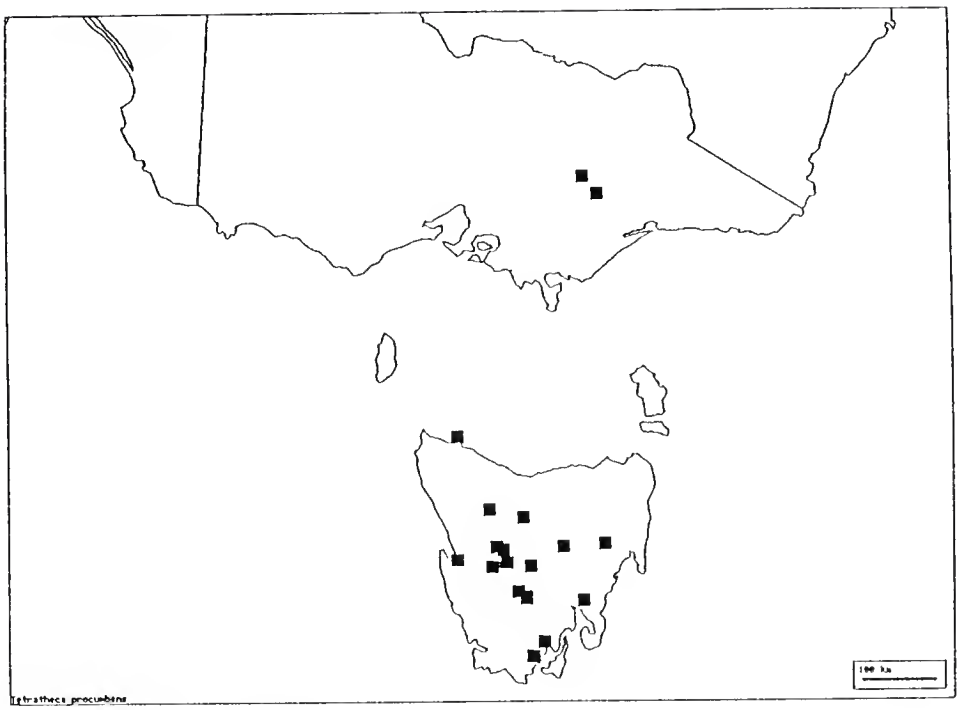

Fig. 3 Distribution of *Tetratheca procumbens*.

The distinetiveness of *T. procumbens* has been reeognised by its various eolleetors over the past 140 years. A eombination of features readily distinguish most speeimens even in the dried and pressed state. Plants are small and proeumbent with mueh braneh-ing near the base and stems that seldom extend for more than about 20 em. They are quite seabrous and often have oeeasional tuberele-based hairs on the stems and leaf undersides and margins. The leaves are small and usually subopposite, alternate or arranged in irregular whorls of three. The flowers are small and produeed singly in the leaf axils on short, glabrous peduneles. The petals are usually pale lilae-pink with darker longitudinal veins, sometimes apparently fading to white.

Some fragmentary material, partieularly from low altitude areas of Tasmania (ineluding the type of *T. pilosa*), is diffieult to identify with any eonfidenee. Extensive field study is required to determine the morphologieal limits of the taxa in the *T. pilosa* eomplex growing in lowland habitats of Tasmania. Pending the outeome of such a study it would seem prudent to retain *T. procumbens* as a distinet entity partieularly in view of the isolated Vietorian populations and their possible threatened status.

In Vietoria the three taxa oeeupy distinet geographieal areas with little overlap in their ranges and no reports of any two being sympatrie. All three are generally identified easily in the field in Vietoria and from herbarium material eolleeted in that State.

CONSERVATION STATUS

Widespread and apparently well eonserved in Tasmania; oeeurs within the Alpine National Park in Vietoria but so few eolonies are known that it is probably best regarded as vulnerable.

SELECTED SPECIMENS (41 speeimens examined)

VICTORIA: Moroka Range, 2 Nov. 1973, *Beauglehole 43483 & 43478* (MEL 1518271, MEL 1518270, NSW 368296); Eastern Ranges; South Bryce Plain, Snowy Range, 24 Nov. 1980, *Walsh 984* (MEL 641258).

TASMANIA: St. George's Bay, 1892, *W. Fitzgerald* (MEL 1008242); Southport, *Stuart* (MEL 10077949, MEL 659452); Charlotte Cove, 14 Oct. 1984. *A. Moscal 8661* (MEL 1620760); Near Lake Dobson, Mt. Field National Park, 14 Dec. 1952, *R. Melville 2368* (MEL 521058, NSW 368286); Mt. Ironstone, Dec. 1900, *F.A. Rodway* (NSW 119682); Circular Head, 8 Nov. 1837, *R.C. Gunn 217* (NSW 119678, NSW 119679);

Ironstone, Dec. 1899, *F.A. Rodway* (NSW 114023); Cradle Mountain, Dec. 1915, *F.A. Rodway* (NSW 119677); Between Bronte & Derwent Bridge, 18 Nov. 1960 & 24 Nov. 1965, *M.E. Phillips 729* (CBG 002996, CBG 013807); Cradle Mountain, 16 Dec. 1990, *M.M. Richardson 395* (CBG 9012276); 7 miles down from Butler's Gorge towards Tarraleah, 4 Dec. 1965, *M.E. Phillips 1049* (CBG 031298); Mt Field National Park, 15 Dec. 1929, *H.F. Comber 1848* (HO 23320, HO 23318, HO 23323); Lake St Clair, 21 Dec. 1937, *H.D. Gordon* (HO 23360); Snow Hill, 12 Nov. 1988, *P. Collier 3756* (HO 118672); Lyall Highway near Lake St Clair, 30 Nov. 1971, *W.M. Curtis* (HO 29421, HO 29425); Gravel pits, Southport, 7 Dec. 1958, *W.M. Curtis* (HO 23345); Mountain Creek, north of Lake Sorell, 22 Nov. 1987, *P. Collier 3010* (HO 120336); Wombat Moor, Mt Field National Park, Dec. 1944, *W.M. Curtis* (HO 29423); Kelly Range adjacent to Kelly Basin, Macquarie Harbour, Mar. 1979, *S.J. Berrigan 216* (HO 30618).

KEY TO THE TETRATHECA PILOSA COMPLEX IN VICTORIA.

1 Plant procumbent or weakly ascending; stems much-branched basally; branches to c. 20 (rarely to 30) cm long; petals <5 mm long; peduncles <4 mm long in mature flower ..... ***Tetratheca procumbens***

1: Plant erect or spreading; stems not much-branched basally; branches mostly 20-60 cm long; petals >5 mm long; peduncles 4-9 mm long in mature flower 2

2 Leaves mostly alternate, linear to narrow-ovate, usually <1.5 mm wide, margins tightly revolute; ovary glabrous or pubescent, hairs usually short and gland-tipped ..... ***Tetratheca pilosa*** ssp. ***pilosa***

2: Leaves alternate, opposite or whorled, narrow- to broad-elliptic or suborbicular, usually >1.5 mm wide, margins flat, recurved or loosely revolute, particularly near apex; ovary usually with long, hollow, shining hairs ..... ***Tetratheca pilosa*** ssp. ***latifolia***

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New species of *Pronectria*, *Vouauxiomyces*, *Wentiomyces* and *Zwackhiomyces* from Australasia

Sergey Y. Koudratyuk

N.G.Kholodny Institute of Botany, Tereshchenkivska 2, 252601 Kiev, Ukraine.

ABSTRACT

Four new lichenicolous fungi (*Pronectria streimannii* from *Sticta cyphellulata* from Australasia, *Vouauxiomyces brattii* from *Pseudocyphellaria faveolata* from Tasmania, *Wentiomyces tatjanae* from *Pseudocyphellaria coronata* from Tasmania, New Zealand and Papua New Guinea, and *Zwackhiomyces kantvilasii* from *Parmotrema chinense* from Tasmania) are described and illustrated, and their differences from related taxa are discussed.

Introduction

During the study of lichenicolous fungi associated with *Pseudocyphellaria*, *Sticta* and *Lobaria* (Kondratyuk *et al.*, 1994; Kondratyuk & Galloway, 1995; Coppins & Kondratyuk, 1995), a number of new taxa have been found, four of which are described here. Further studies are in progress and will be reported elsewhere.

Taxonomy

1. *Pronectria streimannii* Kondratyuk, Coppins & D.J.Galloway *sp.nov.*

Fungus lichenicola. Perithecia immersa sed erumpescentia, dispersa, obpyriformia vel papillata, aurantiaco-rubra, 270-300(-350) x 300-350 µm. Asci cylindrici, 80-100 x 0-12 µm, 8-spori. Ascosporae cylindriceae, hyalinae vel brunneae, 1-septatae, ornamentatae tuberculis hyalinis 1.0-2.0 µm latis, (10.0-)12.7-16.2 x (7.0-)8.1-10.1 µm.

TYPUS: Queensland: Barron State Forest, Herberton Range, 11 km SSW of Atherton. 7°22'S, 145°36'E, 1050 m, rain forest, logged in the past. On treelet stem. On *Sticta cyphellulata* (Müll.Arg.) Hue, 2 Mar. 1983, *H. Streimann 27294* (CBG 830 4195).

Lichenicolous fungus, parasymbiotic on the thallus of *Sticta cyphellulata*, producing pale pinkish, rosaceous, orangish to slightly orange-brownish and reddish-violet ascomata. *Ascomata* perithecioid, immersed, developed in medium layer of the host thallus and very characteristically damaged upper cortex of the thallus of the host, single or appearing aggregated, obpyriform and conspicuously ostiolate, 270-300(-350) µm diam. and up to 300-350 µm high, near ostiole about 80 µm thick and 100-130 µm high; wall equal in thickness or somewhat broader in the vicinity of ostiole, prosenchymatous, composed of 3-6 layers of polyangular cells; outer layers of cells reddish-brown, cells 6.7-10.5(-12.2) x 2.2-7.8 (-8.9) µm, with more or less thickened walls; inner layers less intensely pigmented to hyaline and thin-walled cells, 7.8-13 x 1.1-2.2 µm. *Paraphyses* absent. *Asci* arising from the base of the ascomatal cavity, cylindrical, 80-100 x 10-12 µm, 8-spored. *Ascospores* monostichously arranged in the asci, remaining in these lines after release from the asci, ellipsoid with rounded apices when young, soon becoming more or less cylindrical, olivaceous brown before release from the asci, walls rather thick, well developed (and easily visible in the light microscope), verruculose (with warts 1.0-2.0 µm diam.), (10-)12.7-16.2 x (7.0-)8.1-10.1 µm. (Fig. 1 a-d, 2 a-d, 6 c)

NOTES

With its large perithecia and rather wide and verruculosely ornamentated ascospores, *P. streimannii* resembles the Icelandic species *P. ornamentata* (D.Hawksw.) Lowen, known from *Peltigera* thalli (Hawksworth, 1982), and the Tasmanian species *Polycoccum jamesii* D.Hawksw., known from *Psoromidium versicolor* (J.D.Hooker & Taylor) D.J.Galloway (Hawksworth & Diederich 1988). *Pronectria ornamentata* differs from the new species by its non-papillate perithecia, 4-spored asci, and by its ascospores which are elongate-ellipsoid, rounded at the apices, and much longer (19-)25-31(-33) x 7-9(10) µm. *P. streimannii* differs from *Polycoccum jamesii* by its pale pinkish, rosaceous, orangish to slightly orange-brownish and reddish-violet ascomata which do not

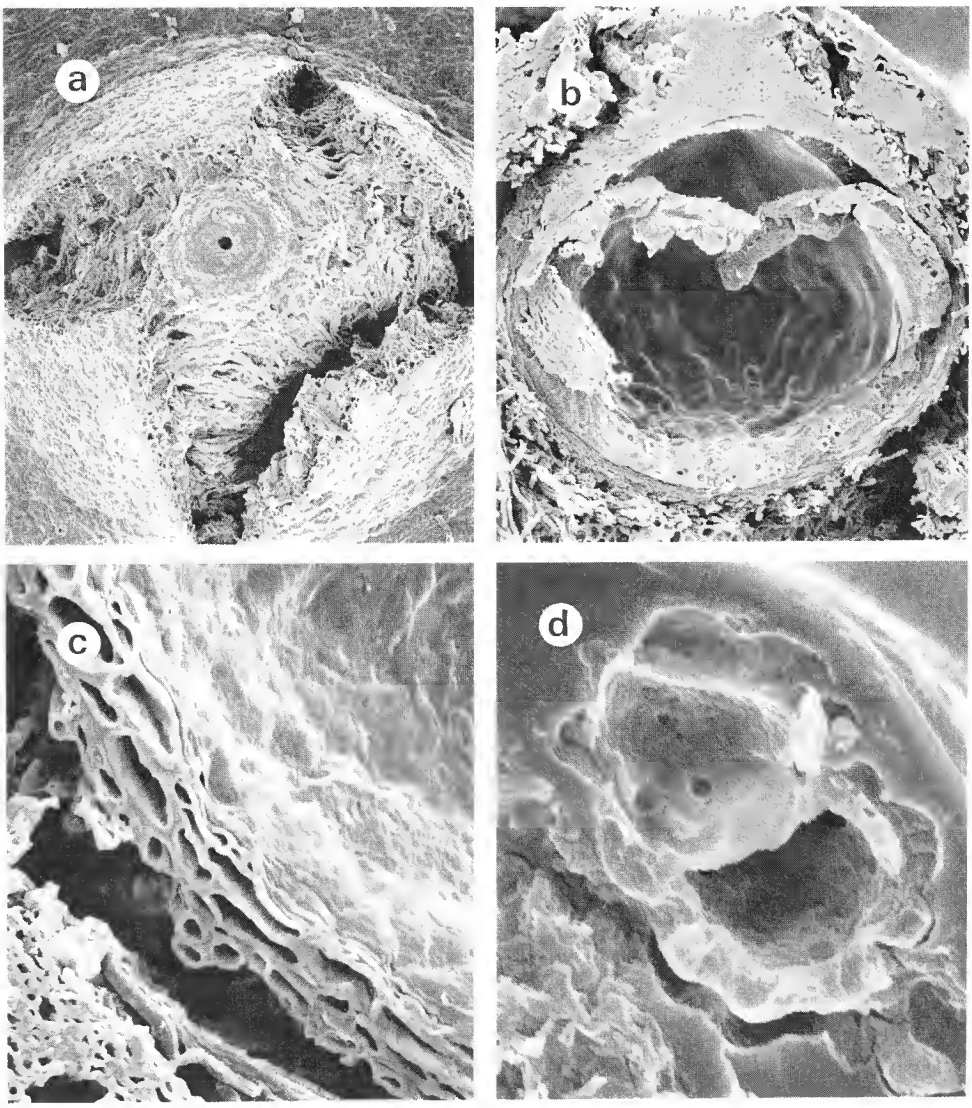

Fig. 1. *Pronectria streimannii*. a - ascomata on the host thalli, x140. b - section of perithecium, x220. c - wall of perithecium, x1420. d - ascospore, x5000.

arise in convex galls; by the lack of persistent branched and anastomosing cellular pseudoparaphyses, and by the strongly cylindrical asci with monostichously arranged ascospores, which remain in these lines after release from the asci. In contrast, the asci of *P. jamesii* are elongate, with more or less distichously arranged ascospores.

Another somewhat similar species is *Polycoccum bryonthae* (Arnold) Vězda which differs in having ascomata which are erumpent from the apothecia of the host (rather than from the host thallus), much smaller perithecia [70-100(-150) µm], and in having persistent, branched and anastomosing cellular pseudoparaphyses. The ascospores of *P. bryonthae* also differ, being only slightly verruculose and narrower [(10-)11-13(-15) x (4-)4.5-6 µm] than those of *Pronectria streimannii*. The substrate of the two taxa also differs, with *Polycoccum bryonthae* occuring on *Caloplaca* and *Pertusaria* species.

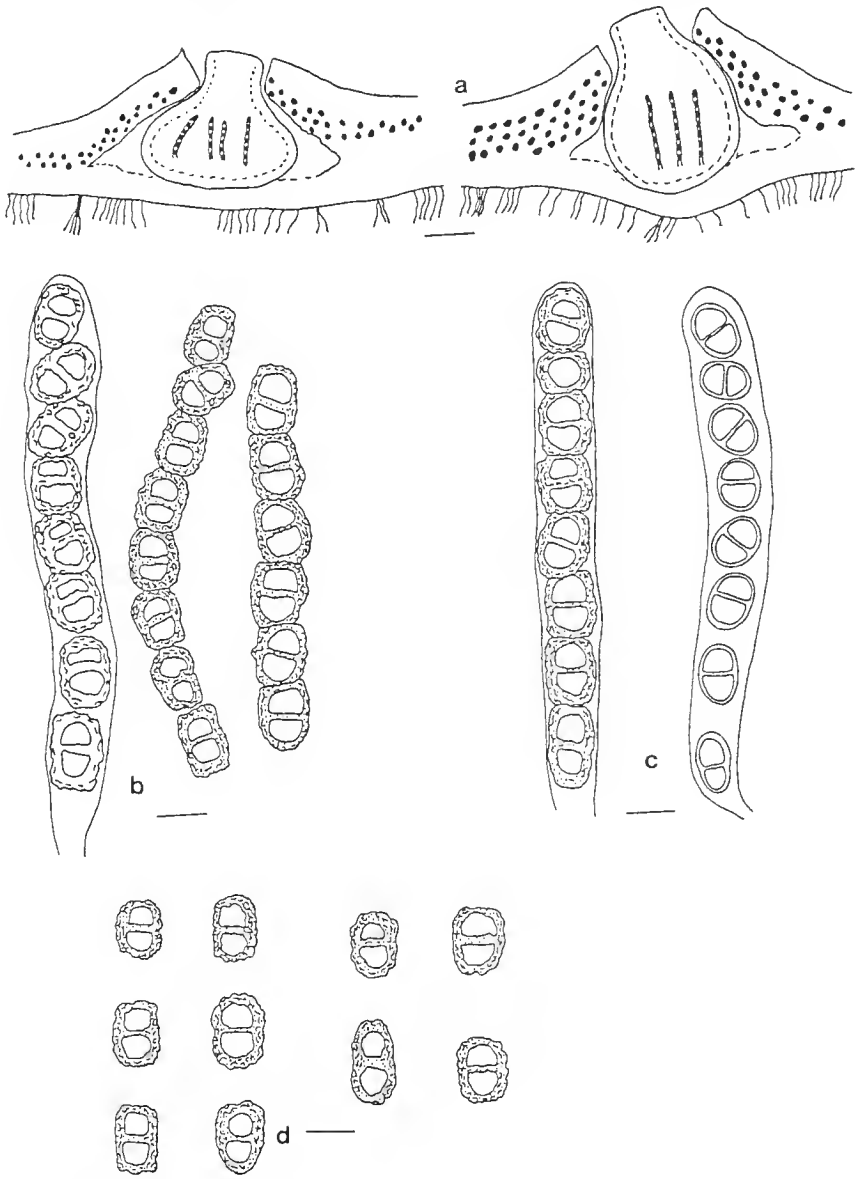

Fig. 2. *Pronectria streimannii*. a - section of perithecium, scale 70 mm. b - ascus and ascospores after release from the asci, scale 7 mm. c - asci, scale 7 mm. d - ascospores, scale 7 mm.

2. *Vouauxiomyces brattii* Kondratyuk *sp. nov.*

Fungus lichenicola. Conidiomata pycnidiformia, semi-immersa vel erumpia, aggregata, 56-330 µm in diam., in gallis immersa, muris textura angulari. Cellulae conidiogenae ampuliformes vel lageniformes, hyalinae, 8.0-10.0(-14.5) x 3.0-4.0 µm. Conidia holoblastica, clavata vel pyriformia, hyalina, simplicia, apicibus rotundatis et basi truncatis, (12-)13.5-16.5(-17.5) x (4.0-)4.5-5.5 µm.

TYPUS: Tasmania: 'Fern Bower' Sth of Maydena. On *Pseudocyphellaria faveolata* (Delise) Malme. [no date], *G.C. Bratt, M.H. Bratt & WST* (HO 34317).

Lichenicolous fungus, parasymbiotic on the thallus of *Pseudocyphellaria faveolata*, producing black conidiomata occuring on wart- or gall-like deformations of the host thalli. *Conidiomata* pycnidial, immersed at first but becoming erumpent through the surface of the host, mainly aggregated in groups in blackish stromatic tissues of warts or gall-like deformations (0.6-1.0 mm diam. and 0.4-0.5 mm high) of the host thalli, black, 56-330 µm diam. and 28-111 µm high; wall of mainly 6-8 cell layers, 11.2-16.8 µm thick, dark brown, pseudoparenchymatous (textura angularis), cells thick-walled, 3-4 µm diam. *Conidiogenous cells* holoblastic, ampulliform to lageniform, lining the pycnidial cavity, percurrently proliferating, annellate with to 3-(4?) annellations, hyaline, smooth-walled, 8.0-10.0(-14.5) x 3.0-4.0 µm. *Conidia* arising singly, obpyriform, often rather irregular in shape, hyaline, collecting in a macilaginous mass in the pycnidial cavity, simple, apex rounded, the base conspicuously truncated, thin-walled, smooth-walled (12-)13.5-16.5(-17.5) x (4.0-)4.5-5 µm. (Fig. 3 a-b)

NOTES

Vouauxiomyces brattii differs from the other species of *Vouauxiomyces* in having much bigger conidia; in contrast, these are 3-5(-6) x 2-3.5(-4) µm in *V. ramalinae* (Nordin) D.Hawksw. and (7-)7.5-10.5(-11.5) x (5-)5.5-7(-7.5) µm in *V. santessonii* D.Hawksw. (all data according to Hawksworth 1981), and 4.5-5.5(-6) x 2.5-3.5 µm in *V. granulatae* Wedin (Wedin 1994) occuring on *Pseudocyphellaria granulata* from Argentina. *Vouauxiomyces* species are anamorphs of *Abrothallus*, but no such anamorph was present among the material of *V. brattii.*

3. *Wentiomyces tatjanae* Kondratyuk *sp. nov.*

Fungus lichenicola. Ascomata superficialia, uniloculata, dispersa, singularia, nigra, globosa, ostiolata, setosa, (80-)120-280 µm diam; setae atrobrunneae, simplices, rectae vel leviter arcuatae, leaves, 18-36 x 2.5-5.5 µm; muris 6-12 µm crassis, e 3-4 stratis cellularum et pseudoparenchymaticarum constantes. Paraphyses desunt. Asci cylindrici, bitunicati, (40-)54-63 x 5.5-6.5(-7.0) µm, 8-spori. Ascosporae ellipsoideae, 1-septatae, hyalinae, laeves, 6.0-11.0(-12.0) x (1.5-)2.0-3.5(4.0) µm.

TYPUS: Tasmania: Florentine Valley, by track 7, about 55 miles [88 km] WNW of Hobart, in high forest of *Nothofagus cunninghamii* in moderate shade with numerous mosses, growing on fallen logs, on *Pseudocyphellaria coronata* (Müll. Arg.) Malme thalli, 13 Dec. 1952, *R .Melville with J.H. Willis, W.M. Curtis & D. Paton 2339* (HOLOTYPUS: BM).

Lichenicolous fungus, parasymbiotic on *Pseudocyphellaria* and *Lobaria* thalli and apothecia, forming black setose ascomata. *Ascomata* superficial, uniloculate, perithecioid, scattered, arising singly or rarely in groups of 2-3(-7), black, globose and very often collapsed, ostiolate, setose mainly on whole surface of peritecia or particularly around the ostiole, (80-)120-280 µm diameter. *Setae* numerous (20 and more), dark brown, simple, straight or slightly arcuate, smooth-walled, thick-walled, 18-36 x 2.5-5.5; walls 6-12 µm thick, pseudoparenchymatous, composed of 3-4 layers of cells, brown-blackish, K+ greenish. *Paraphyses* absent. *Asci* very numerous, arising in a

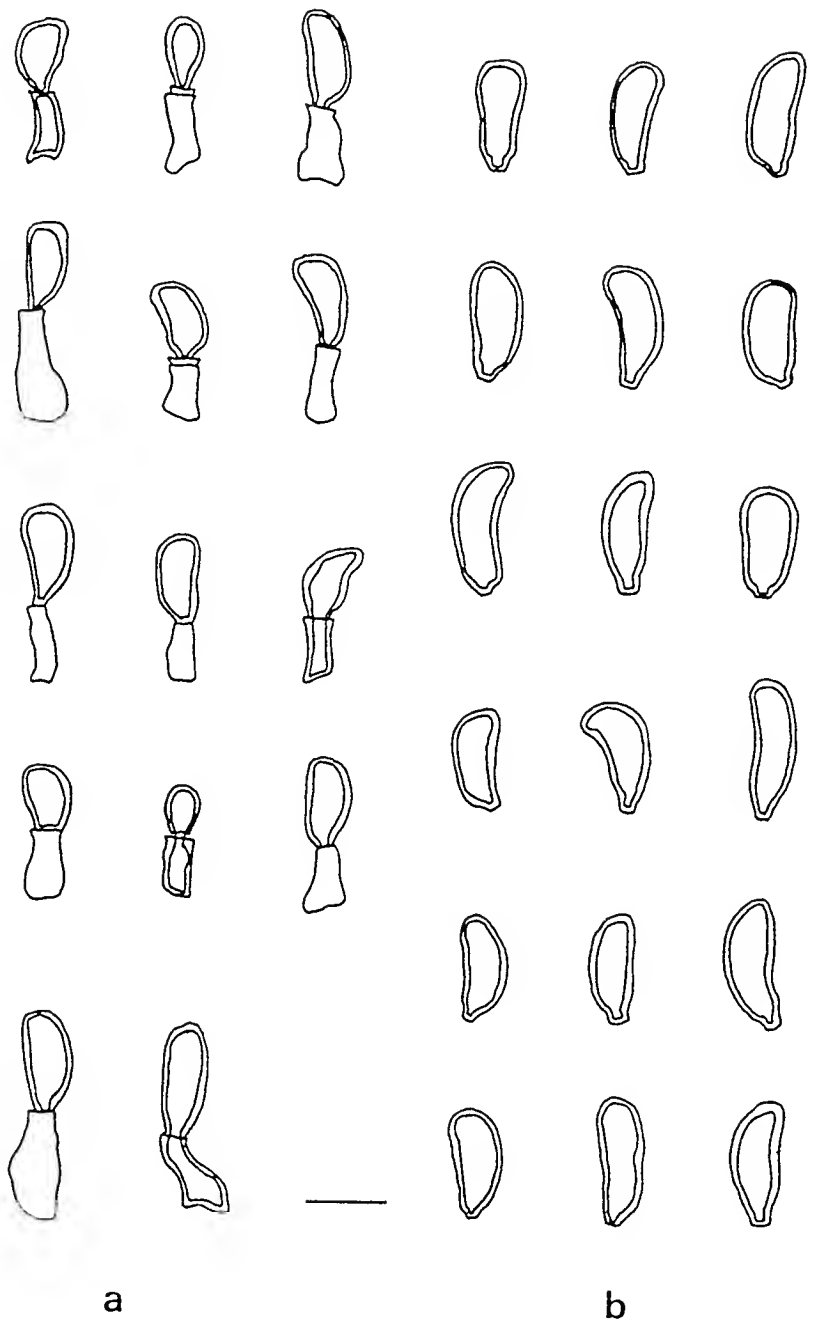

Fig. 3 *Vouauxiomyces brattii*. a - conidiogenous cells, scale 7 mm. b - conidia, scale 7 mm.

fascicle from the base of the perithecial cavity, narrowly cylindrical to cylindrical, with 8 ascospores arranged in 1(-2) lines, (40-)54-63 x 5.5-6.5(-7) µm. *Ascospores* ellipsoid, 1-septate, slightly constricted at the septa, the cells sometimes rather unequale in size, hyaline, smooth-walled, 0-4 guttulate, 6.0-11.0(-12.0) x (1.5-)2.0-3.5(-4.0) µm. (Fig. 4 a-d, 5 a-c, 6 a-b)

NOTES

The new species differs from *Wentiomyces peltigericola* D.Hawksw. (Hawksworth 1980) in having much larger perithecia (80-125 µm in *W. peltigericola*), smaller ascospores (12-16 x 3.5-4.5 µm in *W. peltigericola*), and in having different hosts, *W. peltigericola* occurring on species of *Peltigera aphthosa* group.

Both *Wentiomyces tatjanae* and *W. peltigericola* show some superficial similarity to *Niesslia cladoniicola* D.Hawksw. & W.Gams (Hawksworth 1975), a species which grows on aged *Cladonia rangiformis* Hoffm. podetia. However, *N. cladoniicola* differs from the new species by having a much thicker perithecium wall consisting 4-6(-8) layers of cells, having persistent paraphyses and unitunicate asci, and much narrower ascospores (4.5-8 x 1.5-2 µm).

ADDITIONAL SPECIMENS EXAMINED

NEW ZEALAND: On *Pseudocyphellaria coronata* (Müll.Arg.) Malme thalli, 1843-1844, *W. Stephenson* 40 (BM ex Herb. R.J. Shuttleworth).

PAPUA NEW GUINEA: Southern Highlands: Munia Logging Area, 14 km NW of Jalibu, 2300 m alt., *Nothofagus* and *Podocarpaceae* dominated forest, on fallen, dead tree branch, on *Sticta* cf. *boschiana* thalli and apothecia, 8 Sep. 1982, *H. Streimann* 23329 (CBG).

4. *Zwackhiomyces kantvilasii* Kondratyuk *sp. nov.*

Fungus lichenicola. Ascomata globosa vel irregulariter globosa, 140-180 µm in diam., dispersa, thallo vegetativo hospitis insidentia, semiimmersa vel superficialia, atra. Peridium in sectione longitudinali c. 18-27(-36) µm crassum, castaneum. Hamathecium paraphysoideis, 1.0-1.5 µm diam. Asci cylindrici (40-)54-72(-80) x -10(-11) µm, 4-spori. Ascosporae hyalinc, parietibus distincte verrucose punctatis, 14.5-18.0 x 3.5-4.0(-5.5) µm, 1-septate, 4 -guttulatae.

TYPUS: Tasmania: Tinderbox (near Hobart), alt. sea level, on *Parmotrema chinense* (Osbeck) Hale & Ahti on dolerite in open dry sclerophyll forest, 20 July 1980, *G. Kantvilas* 277/80 (HOLOTYPUS: BM).

Fungus lichenicolous, parasymbiotic on *Parmotrema chinense* thalli forming scattered, globose, black ascomata. *Ascomata* pseudoperithecia, globosa or irregular globosa, scattered, semi-immersed in the beginning, then superficial or immersed in host thallus only at the base, black, 140-180(-200) µm in diam. *Walls* in longitudinal section 18-27(-36) µm thick, blackish brown or dark brown at the base. *Hamathecium* paraphysoids persistent, branched, hyaline, 1.0-1.5 µm diam. *Asci* cylindrical to narrowly cylindrical, (40)54-72(-80) x 8-10(-11) µm, 4-spored. *Ascospores* hyaline, smooth or distinctly verrucose at maturity, 1-septate, 4-guttulate, 14.5-18.0 x 3.5-4.0(-5.5) µm. (Fig. 6 d, 7 a-d, 8 a-b)

NOTES

The new species is most closely related to *Zwackhiomyces euplocinus* Haf., Grube & R.S.Egan and to *Z. sphinctrinoides* (Zwackh) Grube & Haf. (see Grube & Hafellner 1990 for descriptions). *Z. euplocinus* differs in having 6-8-spored asci, 46-60(-65) x 12-14 µm, much wider ascospores (14-18 x 4-6 µm), and by occurring on *Speerschneidera euploca*.

Z. sphinctrinoides differs from *Z. kantvilasii* by its larger perithecia (200-240 µm in diam.), 8-spored asci, 75-85 x 12-14 µm, much longer and wider ascospores [(15-) 15.5-23 x (4-)4.5-6.5(-8.5) µm], and by occurring on '*Lecidea' lurida*.

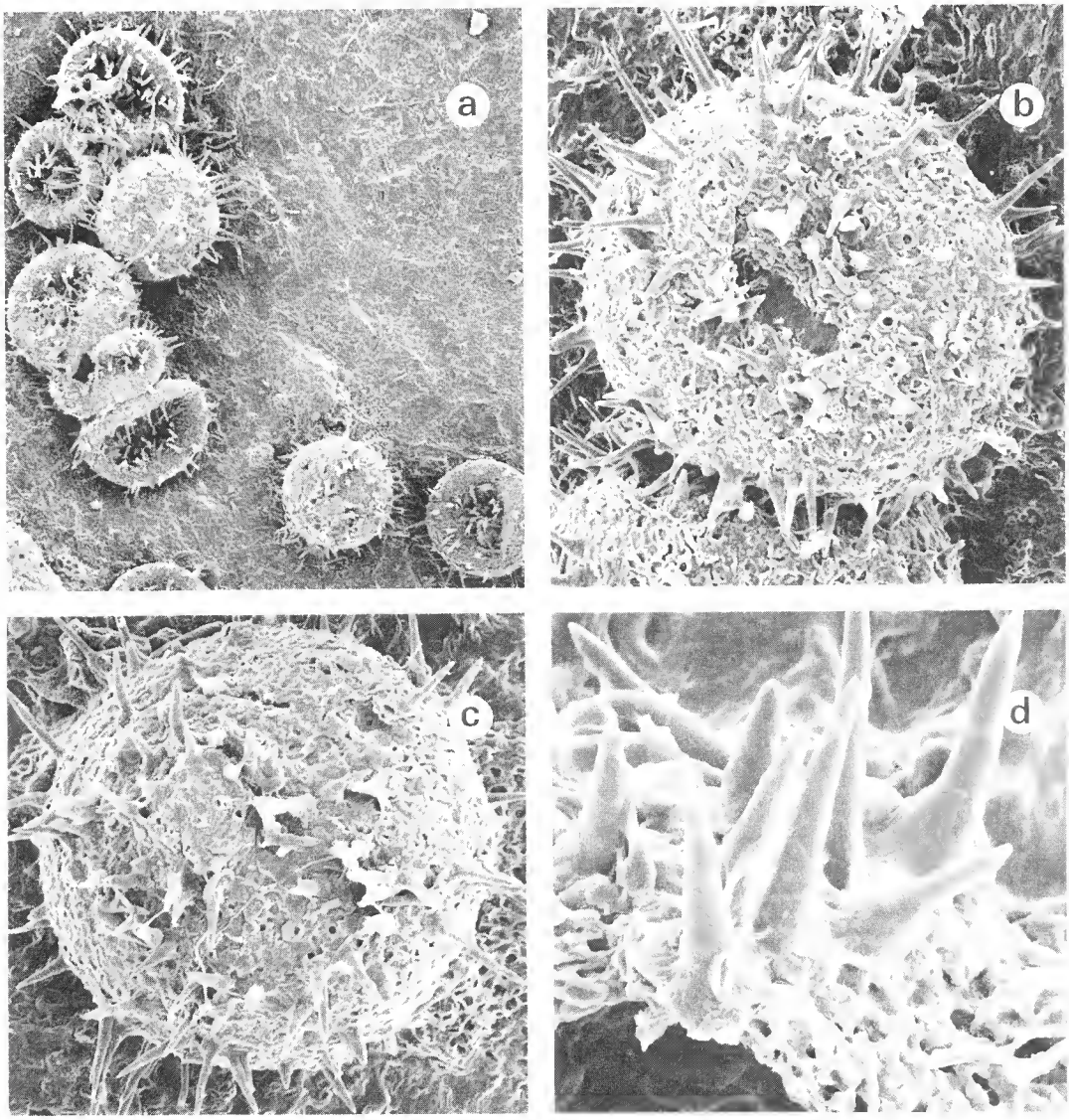

Fig. 4. *Wentiomyces tatjanae*. a - ascomata on the host thalli, x85. b and c - setose perithecium, x355. d - setae, x1420.

ADDITIONAL SPECIMEN EXAMINED

TASMANIA: Notley Gorge, on shaded myrtle at 086 C8/1, 250 feet [c. 76 m], alt., on *Parmotrema chenense*, 2 Jun. 1963, *G.C. Bratt 110* (BM).

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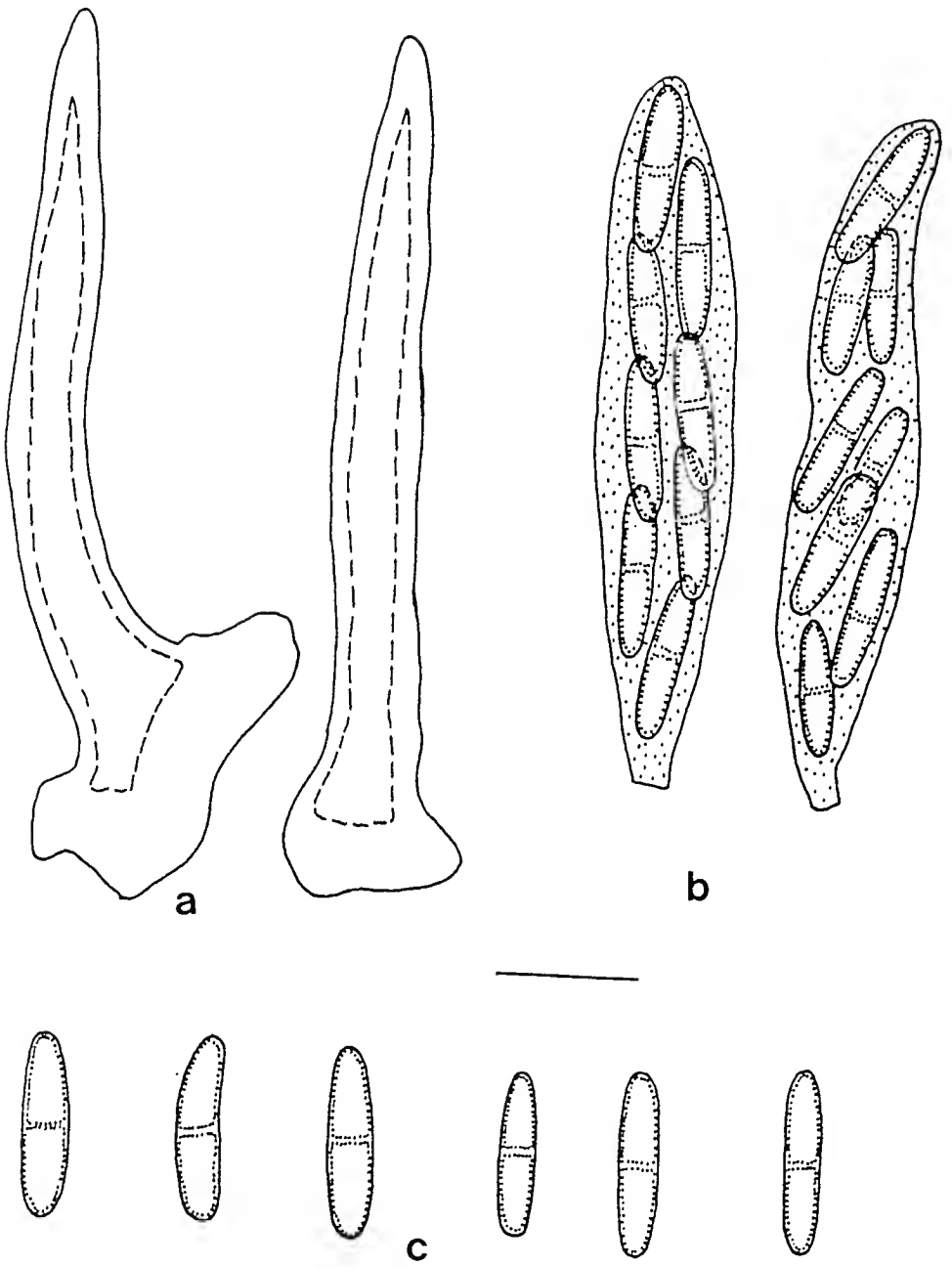

Fig. 5. *Wentiomyces tatjanae*. a - setae, scale 7 mm. b - asci, scale 7 mm. c - ascospores, scale 7mm.

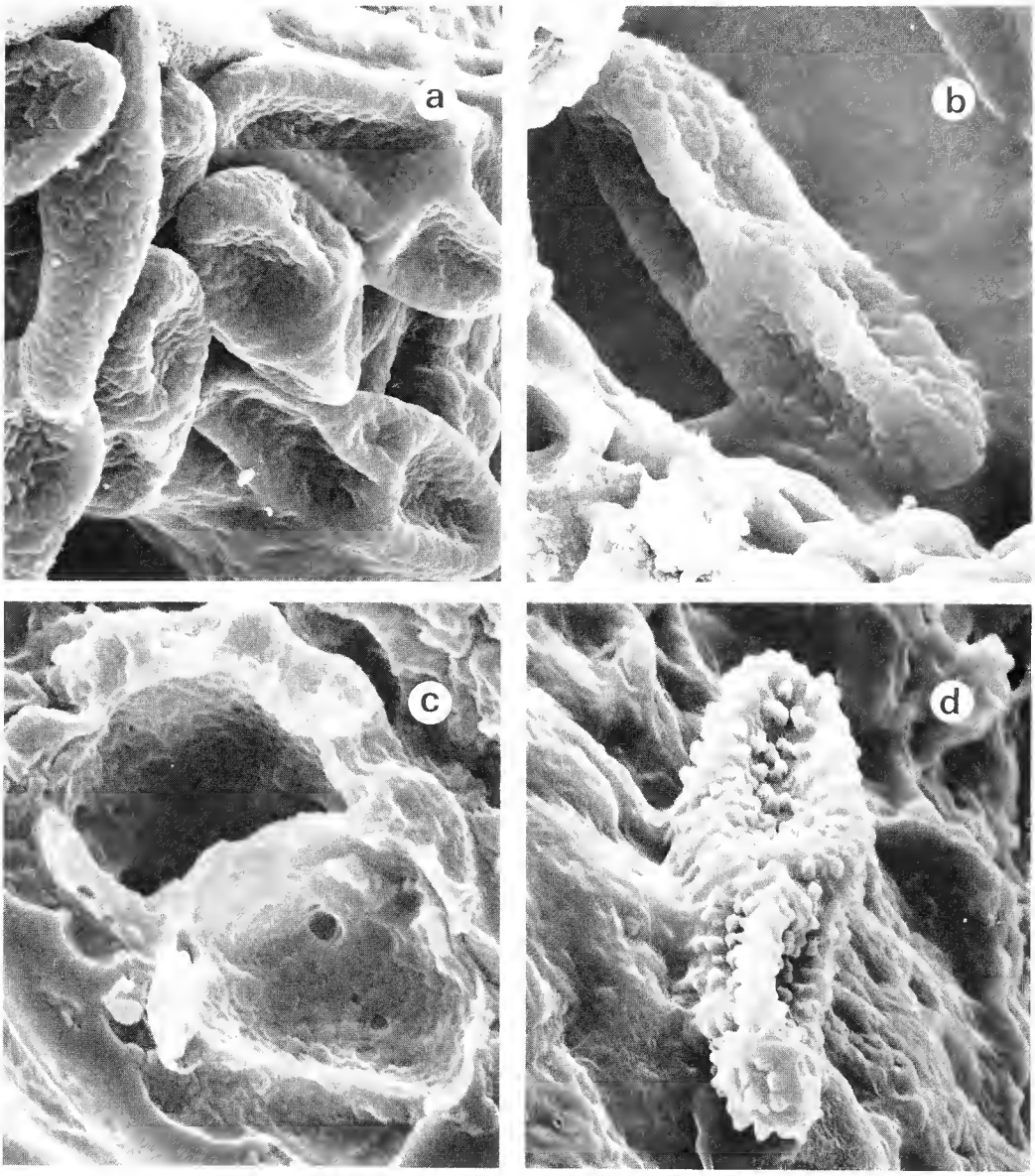

Fig. 6. *Wentiomyces tatjanae*. a - ascospores, x3550. b. - ascospores, x7100. *Pronectria streimannii*. c - ascospores x7100. *Zwackhiomyces kantvilasii*. d - ascospores x5000.

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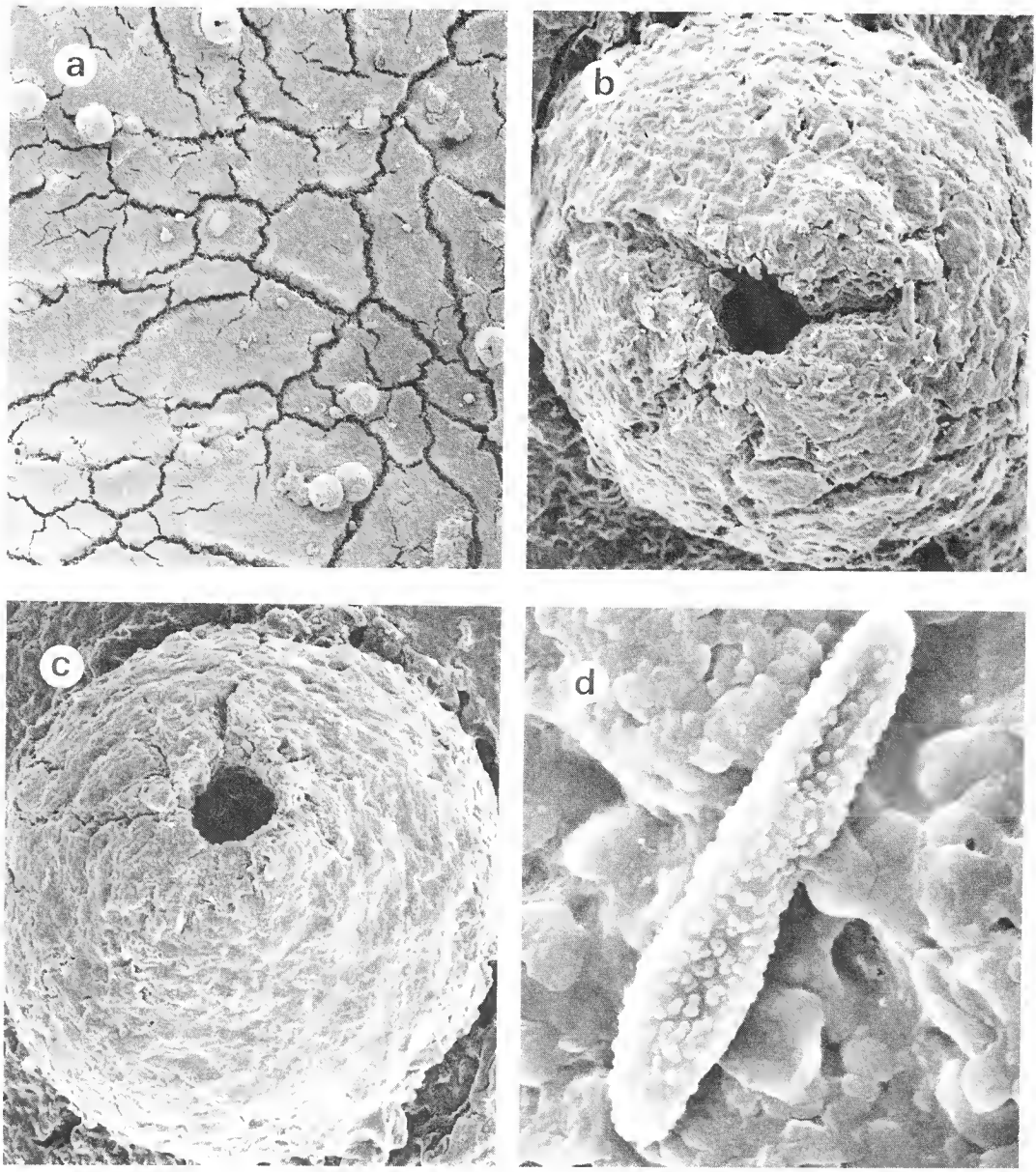

Fig. 7. *Zwackhiomyces kantvilasii*. a - ascomata on the host thalli, x35. b - ascomata on the host talli, x500. c - perithecium, x500. d - ascospores, x5000.

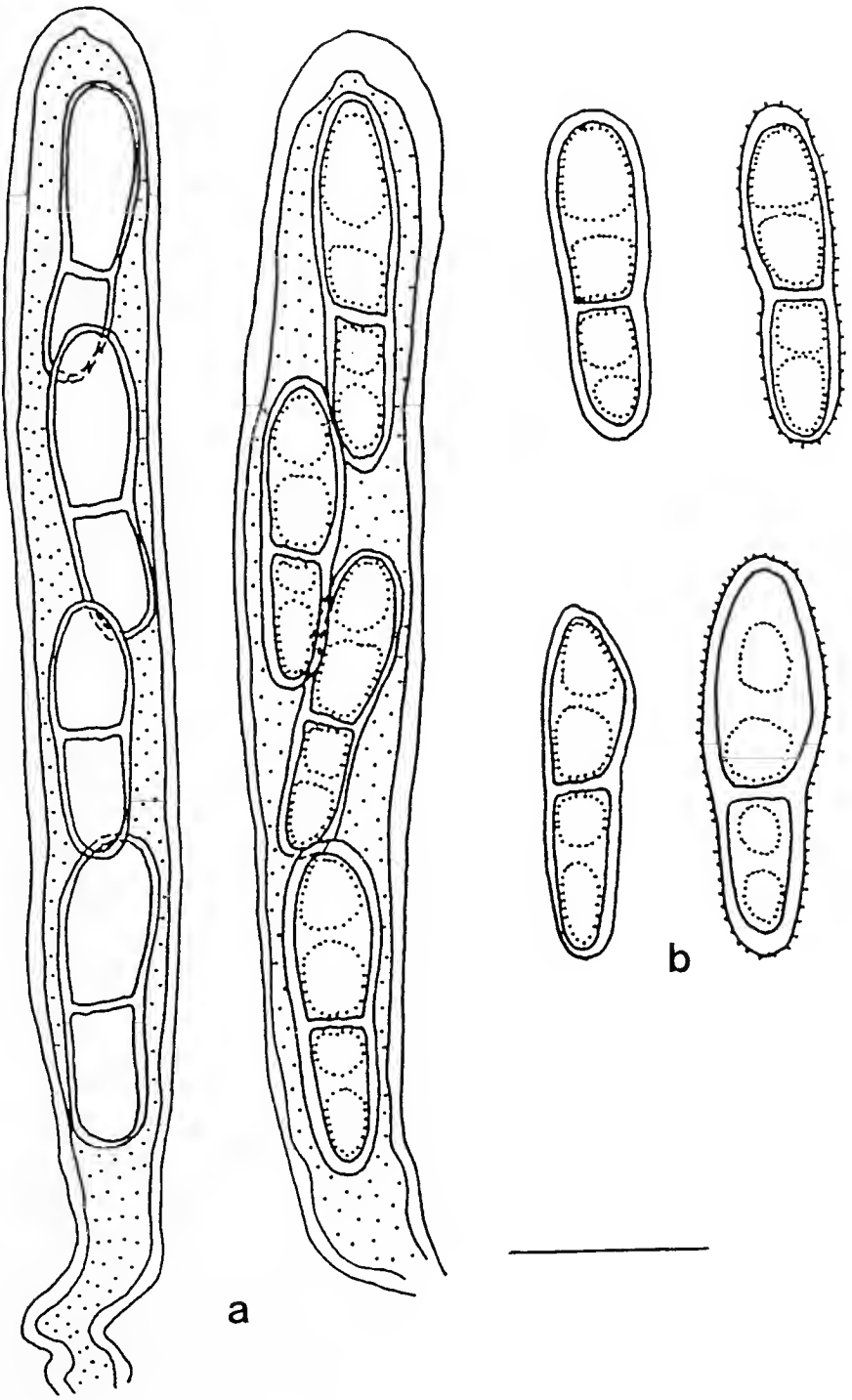

Fig. 8. *Zwackhiomyces kantvilasii*. a - asci, scale = 7 mm. b - ascospores, scale 7mm.

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Muelleria 9: 105–109 (1996)

Dipodium pardalinum (Orchidaceae), a new species from Victoria and South Australia

David L. Jones

Centre for Plant Biodiversity Research, G.P.O Box 1600, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT
Dipodium pardalinum from Victoria and South Australia, related to *Dipodium roseum* D.L.Jones & M.A.Clem., is described and illustrated.

Introduction

Continuing studies into the genus *Dipodium* R.Br. (Jones & Clements 1987, Jones 1991) have revealed the presence of a taxon in western Victoria and south-eastern South Australia which is described here as a new species. This species was first brought to my attention from the Heathmere area by Dorothy and the late Collin Woolcock in 1991, and then by others from different localities in subsequent years. It is mentioned in the notes under *D. roseum* in volume 2 of *Flora of Victoria* (Entwisle 1994). Morphological observations during a field trip in 1994 confirmed its distinctiveness from *D. roseum* and it is here described as new.

Methods

This study is based on the morphological examination of fresh flowers collected from localities in southern Australia, examination of dissected flowers mounted on cards, also dried and spirit-preserved herbarium specimens and photographs of living flowers of the taxa involved. Herbarium collections (spirit and dried) were examined from AD, CANB, HO and MEL. Photographs of types of all pertinent described taxa have been examined including those in overseas herbaria (LINN, LIV). Measurements given in the description are from living plants or dissected flowers on cards. Notes on distribution, habitat (particularly soil and plant association) and conservation status were derived from field studies.

Taxonomy

Dipodium pardalinum D.L.Jones *sp. nov.*

affinis *Dipodium roseo* D.L.Jones & M.A.Clem. a qua floribus perdilutibus roseis aperientibus cito albidis decolorantibus, tepalis grosse maculatis, et medilobo labelli anguste usque late elliptico et grosse punctato differt.

TYPUS: c. 4.2 km W along Jarrets Rd, Heathmere, Victoria, 38°12'S, 141°34'E, 10 Feb. 1994, *D.L. Jones 12836 & B.E. Jones* (HOLOTYPE: CBG; ISOTYPE: AD, MEL, NSW)

Glabrous terrestrial herb. Stem bracts ovate-deltate, to 15 mm long and 20 mm wide, dark brown, fleshy, acute. *Inflorescence* 40-90 cm tall, fleshy, green to dark reddish black, bearing 10-c. 40 flowers in a loose open raceme, the peduncle much longer than the rachis. *Fertile bracts* narrowly ovate-deltate, 5-10 mm long, 2-3 mm wide, scarious, brown, acute to obtuse, closely sheathing to spreading. *Pedicels* 5-10 mm long, slender, slightly twisted, straight or curved, green to reddish brown. *Ovary* narrowly ovoid to narrowly obovoid, 4-7 mm long, 2-3 mm wide, not gibbous, smooth or sparsely verru-

eose, green or dark reddish brown. *Flowers* 20-30 mm aeross, opening very pale pink and quiekly fading to white, with numerous irregularly shaped, eoarse (mostly 0.9-1.3 mm aeross), dark red spots and blotehes, sometimes also with red stainings; tepals strongly reeurved in the distal third. *Dorsal sepal* narrowly ovate-laneeolate to narrowly elliptieal, 12-20 mm long, 3-5 mm wide, obtuse to subaeute. *Lateral sepals* narrowly ovate-laneeolate to narrowly elliptieal, 12-20 mm long, 4-6 mm wide, asymmetrieal, widely divergent, obtuse to sub-obtuse. *Petals* narrowly ovate-laneeolate, 10-20 mm long, 4-6 mm wide, asymmetrieal, obliquely ereet, divergent, obtuse to subaeute. *Labellum* 11-17 mm long, 4.5-6 mm wide, white with eoarse red spots and blotehes and white hairs on the eallus; lateral lobes narrowly spathulate, 3-4 mm long, 0.8-1 mm wide, obliquely ereet, eolumn-embraeing, inner base sparsely puberulous, apex obtuse, often irregular; mid-lobe narrowly elliptieal, 8-12 mm long, 4.5-6 mm wide, apex upeurved, obtuse when flattened, lateral margins reeurved. *Labellum* hairs e. 0.5 mm long, white, ereet, extending from the apex of the eallus to the apex of the mid-lobe, the longest hairs near the middle, overall forming a broad pateh whieh oeeupies most of the ventral surfaee of the mid-lobe. *Callus* eonsisting of two, linear-tapered, eonvergent, pubeseent keels e. 3 mm long, 0.6 mm wide. *Column* porreet from the end of the ovary, 6-7 mm long, e. 3 mm wide, white, fleshy, with a yellow pateh below the stigma on the anterior surfaee, pubeseent below this, saeeate at the base. *Anther cap* e. 1.5 mm long, e. 1.2 mm wide, with a shortly beaked rostrum. *Stigma* elliptieal, e. 1 mm aeross, deeply sunken. *Pollinarium* e. 1.3 mm long; retinaeulum ovate, e. 0.6 mm long; eaudieles e. 0.3 mm long; pollinia e. 0.6 mm long, ellipsoid, waxy, dark yellow. *Capsules* obovoid, 14-18 mm long, 8-10 mm wide, pendant, green to dark red, smooth or sparingly verrueose. (Fig. 1)

ETYMOLOGY

From the Greek *pardos*, *pardalis*, leopard; in referenee to the prominent spots on the tepals and labellum.

FLOWERING PERIOD

Deeember to Mareh

DISTRIBUTION

Widespread in the wetter parts of western Vietoria and extending into south-eastern South Australia. The new speeies is abundant in the forests to the north of Portland (grids E4, E5, E12, E13) and in the vieinity of Ballarat (grids J35, J44, J26, J27, N19, N20, N11). There is also a disjunet easterly reeord from The Basin in the Dandenong Ranges (photo; J.Jeanes *pers. comm.*).

HABITAT

Open forest, usually with an understorey dominated by braeken, sometimes shrubby. Soils inelude tertiary sands, sandy elay loams, auriferous quartz-bearing loams and brown elay loams.

NOTES

It is remarkable that sueh a widespread eommon taxon has remained unnamed for so long. The new speeies usually grows with *D. roseum*, often in very elose proximity, and has more than likely been passed over as a variant of that speeies. Hybrids between the two are unknown despite several searehes. Both speeies have reeurved perianth segments but *D. pardalinum* has mueh paler flowers, whieh open pale pink and quiekly fade to white, with prominent eoarse (mostly 0.9-1.3 mm aeross) reddish spots on the tepals (bright rose pink flowers in *D. roseum* with fine spots and speekles [mostly 0.3-0.6 mm aeross] on the tepals. Whereas the labellum of *D. roseum* is pink with prominent darker stripes and dark pink hairs, that of *D. pardalinum* is white with eoarse reddish spots and white hairs. The overall pale appearanee of the new speeies makes it readily diseernible from a distanee and identifiable in mixed populations with *D. roseum*. Comparable floral eards of both speeies are shown in Fig. 2.

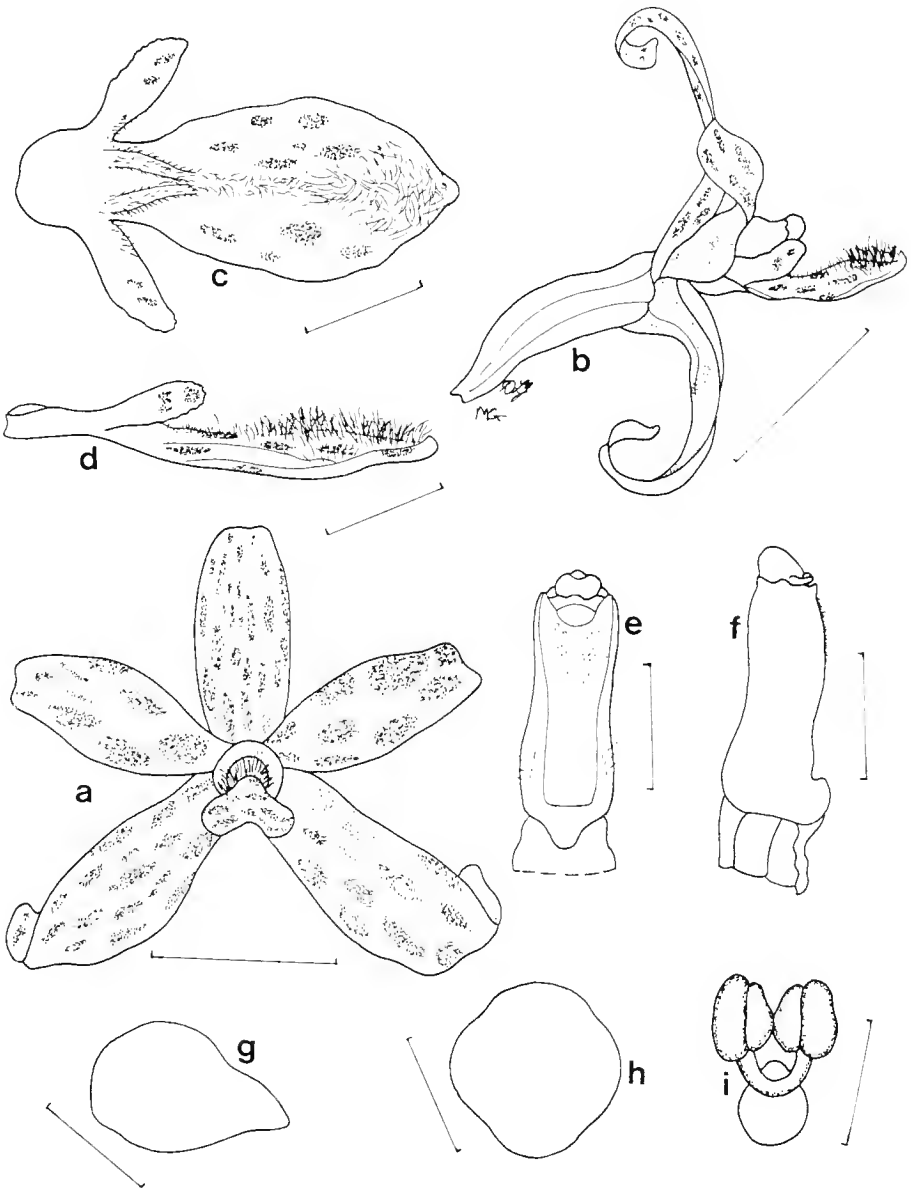

Fig. 1. *Dipodium pardalinum*, D.L.Jones. a - flower from front, scale-bar = 1 cm. b - flower from side, scale-bar = 1 cm. c - labellum from above, scale bar = 4 mm. d - labellum from side, scale-bar = 4 mm. e - column from front, scale-bar = 4 mm. f - column from side, scale-bar = 4 mm. g - anther cap from side, scale-bar = 1 mm. h - anther cap from above, scale-bar = 1 mm. i - pollinarium, scale-bar = 1 mm. All drawn from *Jones 12837* (CBG)

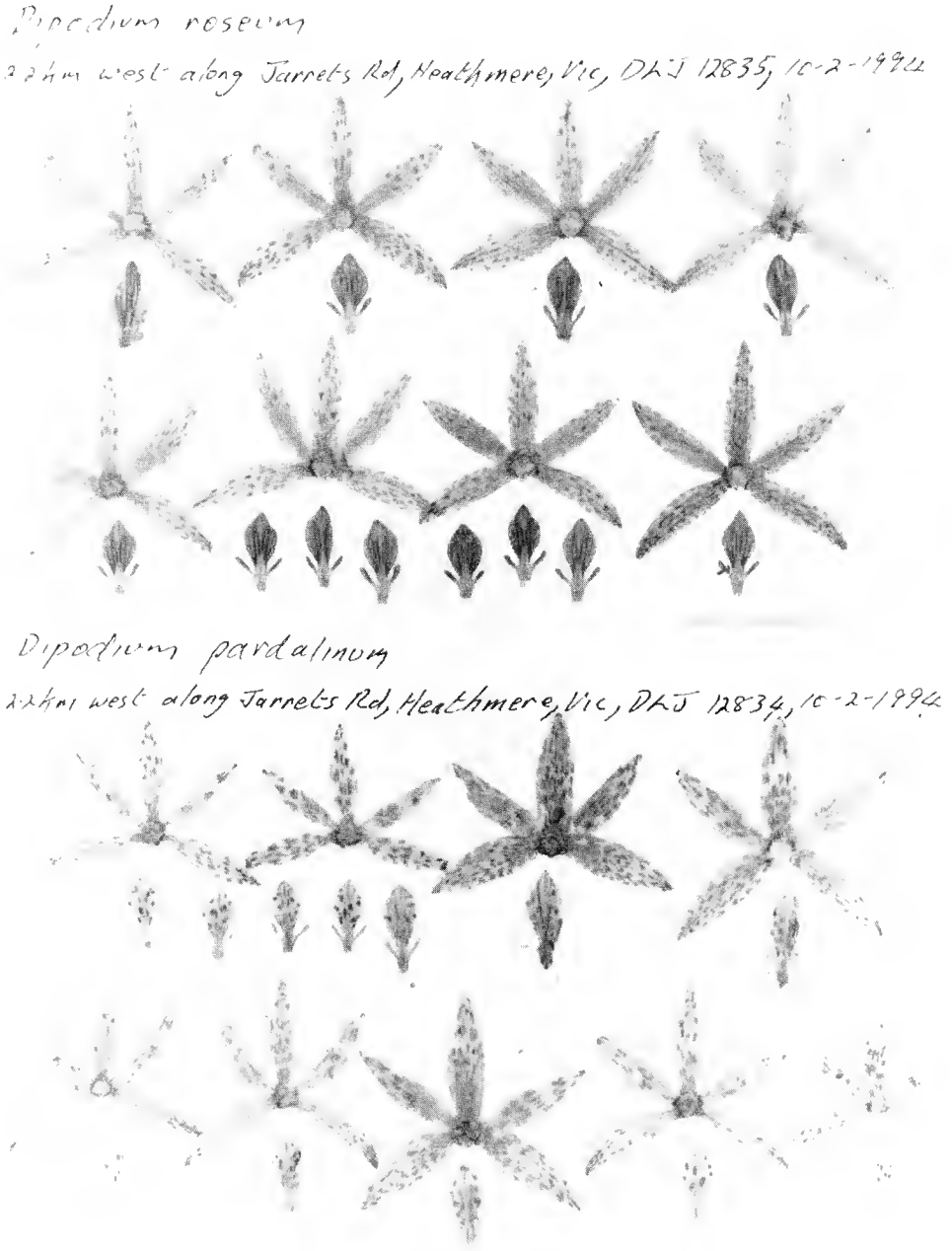

Fig. 2. Dissected floral cards of specimens of *Dipodium roseum* from *Jones 12835* (CBG) and *D. pardalinum* from *Jones 12834* (CBG).

CONSERVATION STATUS
Widely distributed, locally common and conserved in National Parks.

SELECTED COLLECTIONS (17 examined)
VICTORIA: Cobbobonee State Forest, Heathmere, 18 Mar. 1992, *Beecham* (CBG); Bells Reef Rd, c. 5 km W of Daylesford, 21 Feb. 1993, *Entwisle 2181* (MEL); c. 7.7 km along Fish Holes Rd, near junction with Boiling Swamp Rd, Heathmere, 10 Feb. 1994, *Jones 12841* (CBG); Meaghers Rd, c. 15 km N of Portland, 10 Feb. 1994, *Jones 12830* (CBG, MEL); c. 8.6 km N of Heywood, 11 Feb. 1994, *Jones 12842* (CBG); between Smythesdale and Smythes Ck, c. 12 km W of Ballarat, 11 Feb. 1994, *Jones 12845* (CBG); c. 2.4 km SW of Creswick towards Sulky, 11 Feb. 1994, *Jones 12846* (CBG, MEL); Bells Reef Rd, Wombat State Forest, 11 Feb. 1994, *Jones 12847* (CBG); c. 1.3 km SW of Denver, 11 Feb. 1994, *Jones 12849* (CBG, MEL).
SOUTH AUSTRALIA: just N of Naracoorte, 30 Dec. 1994, *Murfet 2146* (CBG).

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Muelleria 9: 111–114 (1996)

The consequences of a footnote: typifications and place of first valid publication of two Australian *Abutilon* (Malvaceae) species published by Mueller

R.M. Barker

c/-State Herbarium of South Australia, Botanic Gardens and State Herbarium, North Terrace, 5000, Adelaide, South Australia.

ABSTRACT

With the addition of a footnote, Mueller invalidated his first publication of two Australian species of *Abutilon*, *A. diplotrichum* and *A. halophilum*. The place of first valid publication is discussed and *A. diplotrichum* is reduced to a subspecies of *A. fraseri*.

Introduction

Mueller published the names *Abutilon halophilum* and *Abutilon diplotrichum* in *Linnaea* in 1853. However the status of *Abutilon* at that time was questionable and he added a footnote (see Fig. 1) to the effect that *Abutilon* was to be considered a subgenus of *Sida*. In doing so it is concluded that he invalidated the combinations in *Abutilon* and furthermore did not make the combinations in *Sida*..

Under Article 33.1 (Greuter *et al.*, International Code of Botanical Nomenclature, 1994), a combination is not validly published unless the author definitely associates the final epithet with the name of the genus. Clearly Mueller did not definitely associate the epithets with *Sida* by his footnote since nowhere does he mention the precise combinations *Sida halophila* or *Sida diplotricha* in this publication. In a later publication, an account of the plants indigenous to the colony of Victoria (Mueller 1860-2), he does refer to them by these names. However there is no evidence that anybody has ever considered that these were the names being published in the original *Linnaea* article (see for example Australian Plant Name Index, Chapman 1991).

A similar argument cannot be used against combinations in *Abutilon* since the headings above the descriptions are clearly *Abutilon halophilum* and *Abutilon diplotrichum*. As a result this paper in *Linnaea* has always been cited as the first place of publication of these names. However, the footnote is sufficient to suggest that Mueller did not accept his own name and thereby contravened Article 34.1 where a name is not validly published when it is not accepted by the author in the original publication.

Sida or Abutilon?

To understand why Mueller was equivocal about the recognition of the two new species as belonging in *Sida* or *Abutilon* requires some understanding of the argument which then existed about the taxonomy of this group.

Prior to Linnaeus's work, Tournefort recognised genera of first rank based on flower and fruit morphology and genera of second rank based on vegetative characters. He was the first to describe *Abutilon* in 1700 on the basis of its fruits and this name was adopted by Miller in his many editions of the *Gardeners dictionary* published between 1721 and 1768. Linnaeus's concept of a genus, based primarily on floral characters, differed from that of Tournefort, and he considered *Abutilon* species to belong under *Sida*. Stearn (1974) gives a very good account of Tournefort and Miller's work in relation to Linnaeus. Linnaeus's concept was followed by Cavanilles (1785) and by de Candolle (1824) in their monographs of the family, but many other authors (e.g.

20. Abutilon*) diplotrichum, fruticulosum, diffusum undique tomento brevi stellari articulato vestitum, pilis longioribus sparse intermixtis, foliis viridulis ovato- vel orbiculato-cordatis obtusis, serraturis subduplicato-crenatis, petiolo aequilongis aut brevioribus, stipulis lineari-filiformibus deciduis, pedunculis tenuibus axillaribus solitariis unifloris apicem versus articulatis denique horizontalibus petiolum parum superantibus, calycis quinquefidi lobis subdeltoideis apiculatis, carpidiis circa decem marginem versus puberulis compressis acutis venosis dispermis calycem aequantibus, seminibus albopuberulis.

In planitiebus semisalsis sterilibus propter Cudnaka.

*) Sidae subgenus.

Fig. 1. The footnote published by Mueller in *Linnea* in 1853.

Gaertner (1791), Kunth (1822) and Walpers (1842, 1851)) treated *Abutilon* as distinct from *Sida* because of its pluriovulate rather than uniovulate carpels. Thus there were two schools of thought that persisted for a century without resolution.

Within Australia, the only species now referred to *Abutilon* to be published before those of Mueller were *Abutilon geranioides* (de Candolle 1824) and *Abutilon fraseri* (Hooker 1848); both were published as species of *Sida* belonging to Sect. *Abutilon*.

Thus Mueller's 1853 publication, his first on this group, came at a time when the taxonomic community was divided as to the status of *Abutilon*.. It is interesting therefore that in this same paper he described a new genus *Abutilaea* with a single species, *A. cryptantha,* and two years later (Mueller 1855) described a further two species within *Abutilon, A. behrianum* and *A. otocarpum,* but this time without reference to *Sida.*

By the 1860's, however, Mueller had changed his mind again. He described three new species within Sect. *Abutilon* of *Sida*, *S. oxycarpa, S. leucopetala,* and *S. cryptopetala* (Mueller 1860) and in a discussion including other Australian Malvaceous genera (Mueller 1862) reduced *Abutilon, Lawrencia, Hoheria, Fleischeria* and *Abutilaea* to *Sida* because the 'carpological characters become confluent by many intermediate forms '.

Bentham's two accounts of Malvaceae (Bentham 1862, 1863), in which he recognised *Abutilon* as distinct from *Sida* on the basis of its 2 or more ovules per cell rather than 1 ovule, seem to have convinced Mueller as to the validity of *Abutilon* as a genus. He described a further three new species (Mueller 1875, 1879) as *Abutilon.* There were problems only with *Abutilon lepidum,* which he placed in *Sida* because of the single seed (Mueller 1868), but he clearly recognised its affinities to *Abutilon* since he distributed and annotated specimens under the manuscript name *Abutilon lepidum.*

FIRST PLACE OF VALID PUBLICATION

Acccpting that the names *Abutilon diplotrichum* and *A. halophilum* were not validly published in *Linnaea*, where was their first place of publication? It was originally thought by the author that the next mention of *A. halophilum* with a clear reference back to the description in Linnaea was by Mueller in 1854 in the *Transactions of the Philosophical Society of Victoria* whereas for *A. diplotrichum* the earliest reference was a listing by Karl Mueller (1857) in Walpers *Annales*, a compilation of new species pub-

lished at that time from around the world. Fortunately, the referee consulted Dr Paul Wilson of PERTH, and he was able to point out that the index or 'Register' to *Linnaea* in which the species are clearly listed as species of *Abutilon* would constitute the first place of valid publication of the names *A. diplotrichum* and *A. halophilum*. Since the editor of *Linnaea* at this time was Schlechtendal, the authorship of the name becomes 'F.Muell. ex Schldl.'.

STATUS OF *ABUTILON DIPLOTRICHUM AND ABUTILON HALOPHILUM*

In my almost completed revision of *Abutilon* for Australia, it has been found that *A. diplotrichum* cannot be maintained at the specific level since it differs from *A. fraseri* (Lindl.) Walp. only in the lack of pubescence on the mericarps. It has consequently been reduced to a subspecies and since the combination is required for the *Flora of Victoria*, this combination is formalised here.

Some doubt has also existed in the past as to the status of *A. halophilum*, since Bentham treated it as a variety of *A. fraseri*. However there is no doubt of its specific status since it differs from that species by its transversely elliptic or very broadly obovate leaves and very much larger fruit. By the structure of its fruit, it is possibly more closely related to the *A. lepidum* complex than to *A. fraseri*.

SYNONYMY AND TYPIFICATION

Abutilon fraseri (Hook.)Walp. subsp. ***diplotrichum*** (F.Muell.) R.M.Barker, *comb. et stat. nov.*

Abutilon diplotrichum F. Muell. ex Schldl., *Linnaea* 25: 751 (Dec. 1853); *Sida diplotricha* (F.Muell. ex Schldl.) F.Muell., *Fragm.* 2: 11(1860); F.Muell., *Pl. Indig. Colony Vict.* 165(1860-2); Previously published description: *Sida (Abutilon) diplotricha* F.Muell., *Linnaea* 25:380 (1853) *nom. invalid* (since the epithet was not clearly associated with one of the genera). LECTOTYPE (**here designated**): In planitiebus semisalsis sterilibus prope Cudnaka [Kanyaka], Oct. 1847[1851], *F. Mueller s.n.*, MEL516338; ISOLECTOTYPE: MEL516348. - Both sheets have been annotated as '*Abutilon diplotrichum* Ferd.Mueller ' and the lectotype sheet was seen by Bentham. The lectotype sheet also bears the annotation '*Sida diplotricha*' but this is probably not in Mueller's hand. The date 1847 is clearly erroneous as Mueller's collections from Cudnaka all date from his visit to the Flinders Ranges in 1851 (Grandison 1990). An undated specimen of *A. fraseri* from the Melbourne Botanic Gardens (MEL111380) has been labelled as *Sida diplotricha* by Mueller; it has no type status but demonstrates Mueller 's changeable concepts concerning the rank of *Abutilon*.

Abutilon fraseri var. *parviflora* Benth., *Fl. Austral.* 1: 205 (1863) *p.p.* only with respect to *Beckler s.n.*, 30 Dec. 1860, Mt Goningberri proper; SYNTYPE: MEL111389, K (Herb.Hooker); ISOSYNTYPE: MEL111388. - Although not from South Australia as cited in the protologue, the syntypes are annotated as *A. diplotrichum* by Mueller and the K specimen has the red pencil determination so characteristic of many of the specimen sheets studied by Bentham.

Abutilon fraseri var. *diplotrichum* (F.Muell.)Domin., *Biblioth. Bot.* 89: 400 (1928) *nom. illeg.* (var. *parviflora* Benth. cited in synonymy).

Abutilon halophilum F.Muell. ex Schldl., *Linnaea* 25: 751(Dec. 1853); *Trans. Phil. Soc. Vict.* 1: 13 (1854); F. Muell. in Hook., *J. Bot. & Kew Gard. Misc.* 8: 10 (1856); Muell.Berol.in Walp., *Ann. Bot. Syst.* 4: 315 (1857); Baker f., *J. Bot.* 31: 268 (1893); A.S.Mitchell, *Fl. Central Australia* 214 (1981); J.G.Reid, *Fl. S.Australia* 2: 824 (1986); A.S.Mitchell & E.H.Norris, *Fl. New South Wales* 1: 332-335 (1990). *Sida halophila* (F.Muell ex Schldl.) F.Muell., *Pl. Indig. Colony Vict.* 165 (1860-2). *A. fraseri* (Hook.)Walp. var. *halophilum* (F.Muell.) Benth., *Fl. Austral.* 1: 205 (1863). Previously published description: *Sida (Abutilon) halophilum* F.Muell., *Linnaea* 25: 381 (1853); *nom. invalid* (since the epithet was not clearly associated with one of the genera). LECTO-

TYPE (**here designated**): Flinders Range, montem Brown, Nov. 1851, *F. Mueller s.n.* (MEL594392); SYNTYPE: between Flinders Ranges and top of Spencers Gulf, Oct. 1851, *F. Mueller s.n* (MEL594393); POSSIBLE SYNTYPE OR ISOLECTOTYPE: Spencers Gulf, *s. dat., Anon. s.n.* (MEL112217 p.p., middle specimen only).

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Australian alpine scapose radiate taxa of *Senecio* (Asteraceae)

Robert O. Belcher

Emeritus Professor, Department of Biology, Eastern Michigan University, Ypsilanti, MI 48197, United States of America.

ABSTRACT

Alpine Australia has a distinctive group of scapose radiate taxa of *Senecio* (*Asteraceae*). *Senecio papillosus* F.Muell. and *S. primulaefolius* F.Muell. are easily distinguished but need clarification of publication date and typification. Two varieties of *S. pectinatus* DC. occur only in Tasmania, var. *pectinatus* and var. *ochroleucus*. The latter, incorrectly attributed to L. Rodway (1903), was validly published by Mueller in 1871. *Senecio pectinatus* var. *major*, found only on the mainland, is described as new. *Senecio leptocarpus* DC is maintained as a species, rather than as *S. pectinatus* var. *pleiocephalus* Benth. A distinct montane pseudolautusoid taxon, described in 1903 as *S. pectinatus* var. *pleiocephalus* Rodway (non Benth.) and in 1969 as *S.* [*aff.*] *lautus* subsp. *alpinus* Ali, is here placed as var. *pleiocephalus* of *S. pinnatifolius* A. Rich. Scapose and subscapose forms of it occur both on the mainland and in Tasmania, along with the more common bushy state. A key to all of these taxa is provided.

Introduction

Candolle in 1838 described *Senecio pectinatus* and *S. leptocarpus* from scapose specimens collected in 'van Diemen's Land' by R.L. Gunn and conveyed to Candolle by Lindley in 1834. These differed in size and inflorescence, the former small and with only one capitulum per scape, the latter larger and with a few heads (oligocephalus). Ferdinand Mueller in 1857 added two more scapose alpine species, *S. papillosus* and *S. primulifolius*, based on collections by C. Stuart in Tasmania. These two taxa have been but rarely collected, are readily distinguishable (as shown in the key below), and have never been in confusion. There are, however, some difficulties with their dates of publication and typification. The spelling of the latter epithet is corrected to *primulaefolius*. The Candollean species have been somewhat controversial. J.D. Hooker maintained both, adding further differences and illustrating a very robust specimen, collected by himself, as *S. leptocarpus*. Bentham reduced this species to *S. pectinatus* var. *pleiocephalus* Benth., meaning 'more than the usual [number of] heads'. Both of these authors included in *S. pectinatus*, in addition to the typical material from Tasmania, certain larger specimens collected by Mueller in the Victorian Alps (which I recognise as var. *major*) and disregarded the varietal epithet included on his labels.

The above-named scapose taxa share a number of traits not seen combined in any other taxon of *Senecio* in Australia. These include consistently scapose habit, strongly reduced number of and large capitula, elongate phyllaries, and unusually long calyeular braeteoles inserted on long tapering receptacles. A further search would probably reveal still other distinctive features held in common. Whether this phenetic grouping is also phylogenetic, or not, should be the focus of a thorough cladistic review which I have not been able to undertake. An appropriate outgroup for that review could well be the pseudolautusoid alpine taxon treated at the end of this paper.

Confusion over the Candollean taxa was compounded by L. Rodway, who began with a good original description of *S. pectinatus* [var. *pectinatus*]. He then wrote:

> 'This species is most variable. The following are marked varieties: var. *ochrolenca* ....var. *leptocarpus* [i.e. var. *pleiocephalus* Benth.] ....var. *pleiocephalus* [non Benth., based on pseudolautusoid specimens from Ironstone Mountain] ....'

He did not cite authorities for these, so 'var. *ochroleuca*' has incorrectly been attributed to him; it actually was validly published by Mueller in 1871 (see below).

Curtis (1963) followed Hooker in maintaining both '*S. pectinatus* / Incl. *S. pectinatus* var. *ochroleuca* Rodway..' and '*S. leptocarpus* DC. / *S. pectinatus* var. *pleiocephalus* Benth.'. Rodway's var. *pleiocephalus* was not mentioned, and its identity has remained obscure until now.

Finally in this context, Ali (1969) described *S. lautus* subsp. *alpinus*, with a very brief diagnosis, and cited specimens from Tasmania as well as from New South Wales and Victoria, some of them clearly scapose. Understandably, he did not connect his new taxon to the pseudolautusoid *S. pectinatus* var. *pleiocephalus* of Rodway, perhaps because of Rodway's puzzling disclaimer about its bracts (see below).

My own observations in numerous herbaria (including all type specimens), plus my experience with some of these taxa in the field, have convinced me that *S. leptocarpus* is a valid species and should be maintained separate from *S. pectinatus*, that var. *ochroleucus* is readily distinguishable in the field and in the herbarium by characters other than just the color of its rays, and that the mainland specimens of *S. pectinatus* are varietally distinct from those of Tasmania. I refer *S. pectinatus* var. *pleiocephalus* L. Rodway (non Benth.) to the *S. pinnatifolius* complex as var. *pleiocephalus*.

KEY TO RADIATE ALPINE TAXA OF *SENECIO*

1 Leaves usually well-distributed up the stem and more or less deeply pinnatipartite; on scapose or subscapose specimens less dissected and rapidly reduced to bracts; capitula 3-4 per unit inflorescence, to 50 or more, cylindrical; phyllaries 13, bi-ribbed, (3.5-)4-5 mm long; calycular bracteoles 1-2.5 mm long in a whorl near apex of peduncle, below but partially enclosing the receptacle ..... ***Senecio pinnatifolius* var. *pleiocephalus***

1: Most leaves crowded near the base, reduced to bracts on the scape; leaves entire or shallowly toothed or lobed; capitula few (2-6) or solitary, broadly campanulate; phyllaries 13-16(-22), not strongly bi-ribbed but flat, 7-8(-12) mm long; calycular bracteoles 4-6(-10) mm long, inserted on the receptacle 2

2 Width of leaf less than 1/4 of its length, blades narrowly elliptic or spathulate or oblanceolate, or long-subpetiolate with short terminal blades 3

2: Width of leaf about 1/3 or more of its length, leaf blades broad, ovate to elliptic to obovate 4

3 Basal leaves narrowly elliptic to obovate or long- subpetiolate, narrowly or broadly lobate or merely serrulate, green beneath, scape with 1 capitulum (rarely 2 capitula) ..... ***Senecio pectinatus* and vars.**

3: Basal leaves spathulate, often briefly subpetiolate, coarsely serrate, silvery beneath; scape with (2-)3-6(-8) capitula (rarely 1) ..... ***Senecio leptocarpus***

4 Leaves petiolate, glabrate above; scape with 1-4 capitula ..... ***Senecio primulaefolius***

4: Leaves sessile or very briefly petiolate, clothed above with short stiff multicellular hairs from tuberculate bases; capitulum 1 ..... ***Senecio papillosus***

Taxonomy

Senecio pectinatus DC., *Prodr.* 6: 372 (1838); Hook.f., *Fl. Tasm.* 1: 222 (1856), *sensu lat.*; Benth., *Fl. Austral.* 3: 664-665 (1867) *pro parte* (excl. var. *pleiocephalus* Benth.).

HOLOTYPUS: Tasmania, 1832, *Gunn 107* (G-DC). ISOTYPI: *Gunn 107* (CGE; K; OXF; probably others, *n.v.*). Note: Hooker gives 'Hab. Mount Wellington, *Gunn*'.

Perennial scapose herbs. Scapes decumbent or erect, terminating in a single large capitulum (rarely 2 capitula, on short peduncles); moderately to densely hairy, hairs reddish, short, multicellular, more or less curled. *Leaves* narrow, green beneath. *Capitulum* pressed to 1-3(-4) cm across, exclusive of spreading rays. *Involucre* broadly campanulate. *Phyllaries* elongate, flat, 1-2 nerved, margins scarious; *calycular bracteoles* linear-

lanceolate, inserted on the long-tapered receptacle, almost as long as the phyllaries. *Rays* yellow or white to ivory.

DISTRIBUTION
Alpine areas of the Australian Capital Territory, New South Wales, Victoria, and Tasmania.

DISCUSSION
This taxon occurs in three clearly marked varieties: two that are endemic to Tasmania, the other confined to high elevations on the mainland. The following descriptions of the well-known Tasmanian varieties are briefer than that of the new mainland var. *major*.

KEY TO VARIETIES OF *SENECIO PECTINATUS*

1 Plants 10-45 (or more) cm tall; basal leaves usually long-subpetiolate, blades with lobes about as broad as long; pressed capitulum 2-3(-4) cm across (exclusive of rays); scapes 2-4 mm in diameter ..... var. ***major***
1: Plants 5-12 cm tall, or slightly more; leaves sessile, crowded; pressed capitulum 1-1.5 cm across (exclusive of rays), scapes c. 1 mm in diameter 2

2 Basal leaves pectinately lobed, lobes about twice as long as broad; lower bracts of scape more or less. pectinately dissected; rays yellow ..... var. ***pectinatus***
2: Basal leaves linear or oblanceolate, serrulate; lower bracts of scape entire or minutely serrulate; rays white to ivory ..... var. ***ochroleucus***

Senecio pectinatus DC. var. ***pectinatus***

TYPIFICATION: as above (*Gunn 107*, G-DC).

Scape (8-)10-15 cm tall, 0.8-1 mm in diameter. *Basal leaves* in a compact rosette, some subpetiolate, lanceolate, 2.5-3(-5) cm long, 3-7 mm broad, imparipinnately lobed. *Lobes* pectinate, 4-5 on either side and 1 terminal, lateral ones c. 1/2 as broad as long, callose-apiculate, inclined 30-45° from the broad rachis. *Bracts* reduced, scattered on the scape; lower ones briefly pectinate with lobes c. 1/4 as broad as long, long-acuminate; upper ones entire, almost linear. *Capitulum* pressed to 1.5-2 cm across, exclusive of rays, c. 1 cm long. *Phyllaries* 13-18, 7-8 mm long, 1-1.5 mm broad, dark-tipped; *calycular bracteoles* 5-6, linear, 6-7 mm long, 1 mm broad. *Rays* c. 13, spreading, 8-9 mm long, 3-3.5 mm broad, yellow to golden yellow. Disc florets c. 30. (Fig. 1a)

DISTRIBUTION
Restricted to Tasmania, on the mountains and plateaux; said by Curtis (1963: 364) to descend to sea-level in the southwest, but I have not yet seen an herbarium specimen labelled as collected below 780 metres.

DISCUSSION
This, the first taxon of this complex to be described, is readily recognisable by its basal rosette of pectinately lobed leaves, the lobes about 1/2 as broad as long. It occurs on many of the same mountains of Tasmania as does var. *ochroleucus*, but the two do not seem to hybridize. A possible reason for this is discussed below in connection with the latter variety.

SELECTED OTHER SPECIMENS EXAMINED
TASMANIA: Mt de la Perouse, 1 Mar. 1857, *C. Stuart 1869* (MEL, initialed 'B', seen by Bentham); Eldon Bluff, Mar. 1873, *Gulliver 24* (MEL); Mt Darwin, 1890, *Moore s.n.* (MEL, P); Hartz Mtn., Dec. 1894, *L. Rodway s.n.* (HO 81449); Mt Ironstone, Dec. 1899, *F.A. Rodway 5102* (NSW 117877); Breona, Great Lake, c. 55 km SW of Launceston, 20 Jan. 1949, *J.B. Cleland s.n.* (AD 97306100); Great Lake, 3300 ft, roadside, 20 Jan. 1949, *L.B. Moore* (CHR 66809); Mt Field National Park, Lake Dobson, wet peaty soil, 22 Jan. 1949, *N.T. Burbidge 3273* (CANB 19598); Near Pine Lake, 1188 m, *Feb. 1957, L.J. Webb 3374* (BRI 270947); Mt Field National Park, Lake Beleher, track beyond saddle, 2 Feb. 1969, *E.M. Canning 2209* (CBG 030969); Cradle

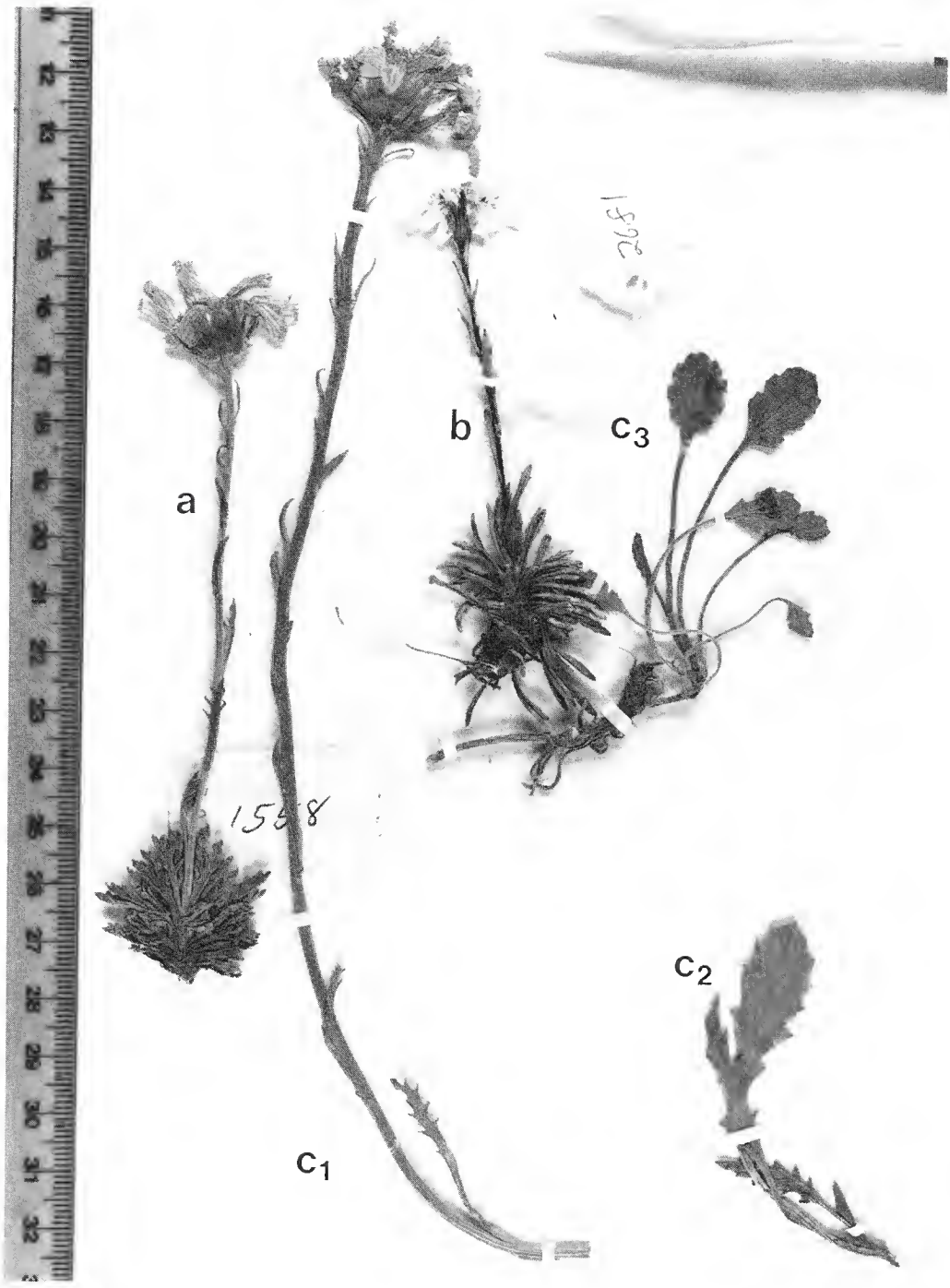

Fig. 1. Varieties of *Senecio pectinatus* DC., contrasted by showing an unmounted specimen of each Tasmanian variety superimposed on a portion of the holotype sheet of var. *major* from Victoria. **a** - var. *pectinatus*; from *R. & R. Belcher 1558*, Cradle Mt (EMC). **b** - var. *ochroleucus*; from *R. Belcher 2681*, Mt Wellington (EMC). **c** - var. *major*; from portion of holotype sheet, *F. Muell.*, Cobboras mountains (MEL 666920). c - 1. upper portion of scape. c - 2. lower portion of same scape. c - 3. short portion of a separate rhizome with clustered petiolate leaves (rhizome for 1 and 2 present on right side of sheet, not shown).

Mtn, c. 50 ft below summit, in crevice in basaltic scree, 23 Feb. 1968, *R.& R. Belcher 1558* (EMC, K); Projection Bluff, 4000 ft, 29 Jan. 1973, *D.A. & A.V. Ratkowsky 66* (MO 2414011, CHR 258334; other duplicates to numerous herbaria, n.v.).

Senecio pectinatus var. ***ochroleucus*** F. Muell., in *Papers & Proc. Roy. Soc. Tasm. for 1870*: 16 (1871) [as var. *ochroleuca*]; var. *ochroleuca* s. auth., L. Rodway, *Tasm. Fl.* 93 (1903); var. *ochroleuca* L.Rodway, Curtis, *Student's Fl. Tasm.* 2: 364 (1963); var. *ochroleucus* L.Rodway, Curtis, *Endemic Flora of Tasmania* Pt. 4: 238 (1973).

Illus. M. Stones, Pl. 74, No. 123, in *Endemic Flora of Tasmania*, Pt. 4: 237 (1973).

TYPUS: Tasmania, Mt Wellington, 4600 ft [1420 m], Jan. 1869, *F. Muell. s. n.* LECTOTYPUS (**here chosen**): MEL 666924; REMAINING SYNTYPES: MEL 666922, MEL 666923. Of the three sheets, MEL 666924 is here chosen as lectotype because it alone has the diagnostic phrase, 'ligulis fere albis'. Labels on the other two sheets carry only the epithet, locality, and date.

Scape (5-)9-15(-33) cm tall, 1-1.2 mm in diameter. *Basal leaves* in compact rosette, 1-2(-2.5) cm long, 1-1.2 mm broad, linear to linear-oblanceolate, serrulate. *Bracts* few, scattered along the scape, linear, subentire, 0.5-1.5 cm long, 1-1.5 mm broad, lower with 1-2 callose teeth near apex. *Capitulum* pressed to 1-1.5(-2) cm across, excluding rays, c. 1 cm long. *Phyllaries* 13-20, 7-9 mm long, 1-1.5 mm broad; *calycular bracteoles* 5-6, linear-lanceolate, 4-6 mm long, 1 mm broad. *Rays* 9-15, 8-9 mm long, (3-)4-5 mm broad, white to ivory. *Disc florets* c. 20-25. (Fig. 1b.)

DISTRIBUTION

In Tasmania where it is common on mountains and plateaux, especially in the south-west. Not known from mainland Australia.

DISCUSSION

Senecio pectinatus var. *ochroleuca* has been attributed to Rodway, even though he himself did not cite an authority. But in seaching unsuccessfully for a Rodway collection made prior to 1903 as a possible type, I came upon three (then unmounted) sets of specimens at MEL, each set with a label reading: 'Senecio pectinatus DC. / var. ochroleuca / Mt Wellington, Tasm. / 4000 ft. Jan 69'. These clearly predated Rodway's account.

Doris Sinkora confirmed that Mueller had indeed spent the first week of 1869 in Tasmania, botanising on both Mt Wellington and Mt Field. A check of citations in the catalogue of Mueller's publications (Churchill *et al.*, 1978: 83 *et seq.*) led to a series of 'Contributions to the Phytography of Tasmania'. No. II, as cited above, contains this entry: 'Senecio pectinatus Cand. prodr. VI. 372; var. ochroleuca [*sic*!]. This variety is frequent on the alpine plateau of Mt Wellington, but I did not observe it on Mt Field East. *It produces short-toothed leaves, single flower heads and ligules almost white* [italics mine]. Although *S. pectinatus* is widely spread over the Australian Alps, I never noticed it with cream-colored rays.' I regard this as valid publication.

This variety was not listed among the taxa of *Senecio* published by Mueller (Muir, 1979: 134). His authorship is here acknowledged, apparently for the first time. Rodway must have obtained the epithet from Mueller's article but failed to credit the source.

The feminine termination of the varietal epithet as given by Mueller and maintained by Rodway and by Curtis (until 1973: 238) has been here modified to masculine in accordance with Articles 24.2 and 32.6 of the International Rules of Nomeclature ('Tokyo Code', Greuter, 1994: 36, 43).

Recognition of var. *ochroleucus* in dried material is easy because of the distinctive leaves and bracts. The rays usually undergo discoloration during drying and are not then reliably different in color from dried material of the typical variety. Gunn surely distinguished between the fresh plants of his *107* and his *1147*, at least in ray color if not in leaf, but (typically) made no comment on it in his labels. I saw no material of var.

ochroleucus at Geneva, either in the Prodromus herbarium or in the general herbarium; Lindley apparently did not forward any of the latter number to Candolle.
The specimens cited below were selected from a much larger number which I have seen, to show the early records and something of the geographical distribution, omitting many from Mt Wellington. It has not to my knowledge been collected from the mainland alps; Mueller's statement, above, remains true.

I have had no opportunity to explore the basis for the differences in leaf, bract, and ray between these two Tasmanian varieties. Even though both have been collected repeatedly from the same mountains, I have seen no specimens that would suggest introgression between the two. There must be some effective barrier to cross-breeding. It may well be that ecological preferences provide the isolating mechanism.

I am indebted to David Ziegler of the Tasmanian Herbarium for this note on the setting for var. *ochroleucus*: 'From personal observation this variety favors sheltered locations amongst large summit boulders on the mountains of South West Tasmania. The sites tend to be at least partially shaded, sheltered from wind and possibly covered with small snow patches well into spring. The mountains are mainly of quartzite rock such as Mt Maconochie but I have seen it on Pindar's Peak which is dolerite. The plant forms loosely matted colonies up to c. 1 m square. On the north-east ridge of Mt Anne it occurs amongst cushion plants in boulster bog surrounded by subalpine shrubbery. This area is possibly subject to heavy and prolonged snow. It also occurs in wet shaded gullies on the southern side of quartzite peaks in the Western Arthur range.'

In contrast, Ziegler stated that var. *pectinatus* is more likely to occur on drier and more open sites, such as the basaltic scree near the top of Cradle Mountain where I found it in 1968. It is true, however, that habitat notes on labels of this variety often mention wet sites. These relationships are in need of further investigation.

SELECTED OTHER SPECIMENS EXAMINED

TASMANIA: 'Table Mountain, Derwent River' [now Mt Wellington], 18-19 Feb. 1804, ***R. Brown*** (CANB 279182, ex BM); Mt Wellington, 7 Jan. 1841 (?), *Gunn 1147* (K, 4 specimens on sheet with 5 specimens of *Gunn 107* [isotypes of var. *pectinatus*]; CGE in herb. Lindley, 4 upper specimens on sheet with 3 specimens of *Gunn 107*; CGE in herb. Lehman). S. loc., 3 Feb. 1849, *Milligan 1055* (OXF); Mt La Perouse, *Stuart* (MEL 667732); '*L.Rodway* [*s.n.*] 1892, Tasm.' on blue Phytological Museum label, det. *S. pectinatus* (MEL); Summit of Mt Wellington, Jan. 1913, *L. Rodway* (HO 14863); Mt Wellington, 6 Jan. 1987, *R. Belcher 2681*, (EMC); Cradle Mtn, between rocks on west side, 8 Jan. 1960, *Hj. Eichler 16507* (AD 96107070); Hartz Mtn. National Park, 15 Feb. 1968, *A. Himson s.n.* (K, used by M. Stones for her Pl. 74); Lake Esperance, subalpine herb field, 6 Jan. 1969, *I.R. Telford 2404* (CBG 828942, NE 024226); 3350 ft, 4 Feb. 1973, *D.A & A.V.Ratkowski 112* (MO 2317166, CHR 257691); Slope of Frenchman's Cap, forming loose mats, 8 Jan. 1981, *Buchanan 458* (CHR 394618).

Senecio pectinatus var. ***major*** F.Muell. ex Belcher *var. nov.*

differt a varietate typica foliis majoribus, petiolis longioribus, paginis spathulatis vel oblanceolatis, lobis fere quadratis; bracteis inferioribus minus reductis; scapis longioribus; capitulis majoribus. (Fig. 1 c.1, c.2, c.3.)

Perennial herbs, sometimes stoloniferous with stolons to 30 cm long. *Scapes* often purplish, glabrate to hairy; (8-)15-30(-50) cm tall. *Lower leaves* not densely crowded but somewhat scattered along base of scape, leaf base slightly flared to 4 mm broad, semi-clasping the node, abruptly reduced to 2 mm as a narrowly winged subpetiole to 4 cm long, expanding into an obovate to oblong-lanceolate terminal blade 1.5-2(-4) cm long and 1-1.5 cm broad, blade coarsely lobed with lobes quadrate (about as long as broad). *Intermediate leaves* reduced in length and breadth, more briefly subpetiolate, with lobes quadrate or reduced to sharp almost linear teeth. *Bracts* on upper part of scape numerous, linear-lanceolate, entire, c. 1 cm long, 1-2 mm broad. *Capitulum* terminal, usually single but rarely a second smaller (less mature?) capitulum arises 3-4 cm below the terminal receptacle and on a peduncle c. 3 cm long; pressed to (2-)2.5-3(-4) cm across, excluding rays; 1.5-1.8 cm long. *Phyllaries* (13-)16-22, 7-12 mm long, 1.5-3 mm broad. *Calycular bracteoles* (6-)8-10, 8-10 mm long, 1.2-1.6 mm broad. *Rays*

(12-)16-20(-22), yellow, 9-13 mm long, 3 mm broad; *disc florets* very numerous (to 90), golden-yellow.
(Fig. 1, c1, c2, c3; holotype.)

TYPUS: Victoria, Cobboras Mountains, [1854], *F. Muell.* HOLOTYPUS: MEL 666920; ISOTYPI: Cobboras Mountains, 6000 ft, *F. Muell.*, MEL 666921 ex Herb. Sonder; K (two specimens and two labels on one sheet, ex Herb. [W.J.] Hook.). The varietal epithet, *major*, means greater [than the Tasmanian varieties].

The holotype (MEL 666920) is annotated: 'Senecio pectinatus DC. / major ferd. Mueller / Weicht von DC Beschreibung / ein wenig in grössern Blumen / u. gezahnten Blattlappen ab / Cobboras Mountains', in Mueller's script. [This label is not shown in Fig. 1.] I am indebted to Doris Sinkora at MEL for this translation: 'differs slightly from de Candolle's description in larger flowers [capitula] and dentate leaf lobes'. This label (and therefore the specimen) is initialed as seen by Bentham. The isotypes at Kew were also annotated by Bentham and cited [as 'Mount Cobberas'] in Flora Australiensis, but without varietal recognition. The year for the type collection is from Gillbank (1992: 477): 'In January 1854 .... Mueller turned east toward the rugged Cobberas mountains and the adjacent plateaux'.

DISTRIBUTION
Australian Alps and higher subalpine areas, in the Australian Capital Territory, south eastern New South Wales, and north eastern Victoria. Not known from Tasmania.

DISCUSSION
I have yet to observe or collect this variety in the field. The herbarium specimens of var. *major* which I have examined exceed those of var. *pectinatus* and of var. *ochroleucus* in almost every dimension, as can be seen in Fig. 1, which shows my specimens of the latter two varieties superimposed on the holotype sheet. Furthermore, the lower leaves of var. *major* are usually long-subpetiolate, a feature not seen on the Tasmanian varieties.

Costin *et al.* (1979: 379) gave an excellent descrirption of var. *major* as '*S. pectinatus* DC. .... Alpine Groundsel'. Their description is not applicable to Tasmanian specimens, although they included Tasmania in the distribution. They then add: 'Common in tall alpine herb fields and sod tussock grasslands; a small, apparently distinct ecotype occurs in *Epacris-Chionohebe* feldmark.' This comment is echoed in an annotation on the Costin collection from near Mt Townsend (CANB 46770), cited above. It reads: 'also occurs as an ecotype on windswept alpine ridges'.

These comments appear to raise the possibility that var. *pectinatus* does indeed occur in the mainland alps. I did not find such a small specimen collected by Costin or by any of the other authors, either at CANB, at CBG, or elsewhere. The nearest approach was *Telford 3607A* (CBG 055449, cited below). This collection consisted of two small plants, one very small and not flowering but vegetatively consistent with the larger one, which is 8 cm long overall including a fragment of root. This latter specimen had one head on a scape 3 cm tall from rosette to receptacle. The capitulum had phyllaries 9 mm long, calycular bracteoles to 5 mm long, and was pressed to 1.3 cm broad and 1.1 cm high, exclusive of the 10 rays. This plant is the closest in size to var. *pectinatus* of any mainland material I have seen, but the scape lacks pectinate bracts. Its leaves, to 2 cm long and 6 mm broad, have 5 pairs of squarish lobes, as in var. *major*, not pectinate. This collection *may* represent the ecotype mentioned, but whether it does or not, it *is* of var. *major* despite its stunted size and *not* a mainland occurence of var. *pectinatus*.

At the other extreme in size are the specimens of *H. van Rees 314* (CANB, HO, below) from the Bogong High Plains in Victoria. It is probably significant that the elevation of only 1640 metres for these van Rees specimens is the lowest of all those cited for var. *major*. Both plants are unusually robust, to 50 cm tall, with the lowest leaf 15 cm long and 2.7 cm broad, and the leaves more scattered up the stem. In this it mimics the behavior of pseudolautusoid alpine *S. pinnatifolius* var. *pleiocephalus* (see below).

That latter taxon usually has fairly well-developed cauline leaves. But there are some high alpine collections which have cauline leaves strongly reduced on decumbent scapes from a basal rosette (but with the typically small numerous heads of that variety), hence my inclusion of it in the group of seapose alpine radiate taxa in this paper.

The larger size of specimens of var. *major* suggests the possibility that they are polyploids of var. *pectinatus*. This is supported by the chromosome count of n=40, $2n$=80 reported by Lawrence (1980: 154) for '*S. pectinatus*'. She made her count from the specimen from 'Spencer Creek, Mt Kosciusko National Park, N.S.W.' [*Lawrence 1397* (AD 98131070), below]. This specimen is clearly var. *major*. This could imply that var. *pectinatus* (and var.*ochroleucus*?) might have counts of n=20 and $2n$=40, but this of course requires investigation.

J.D. Hooker (1856: 222) cited three collections under *S. pectinatus*; namely, '*Gunn (107, 1047)*' from Mt Wellington, and 'Cobboras [sic!] Mountains, elev. 6000 feet, Mueller'. If '*Gunn 1047*' is accepted as an error for the *Gunn 1147* specimens mounted with *Gunn 107* at Kew as cited above for var. *ochroleucus*, Hooker had in hand material of all three varieties. His comprehensive description gives their distinguishing characteristics, hence *sensu latiore*. It is surprising that he did not describe varieties, as he often did in complex taxa.

Bentham's description (1867: 664-665) likewise applied to all three varieties but also incorporated *S. leptocarpus* DC. (as his var. *pleiocephalus*), a position which I challenge (below).

The brief description by Willis (1973: 748), with leaves 'crenately toothed oblanceolate', the Victorian distribution and at least some of the illustrations cited apply only to var. *major* and not to the Tasmanian varieties.

SELECTED OTHER SPECIMENS EXAMINED

AUSTRALIAN CAPITAL TERRITORY: Namagi National Park, about 1/2 km NW of Bimberi trig tower, 1830 m, wet heath, 5 Feb. 1985, *C. Helman 252 & P. Gilmour* (CBG 8601625).

NEW SOUTH WALES (all from within what is now Kosciusko National Park): Snowy Mtns, Feb. 1890, *W. Bauerlen 66* (MEL 1533870). Mt Kosciusko, Feb. 1901, *R. Helms* (MO 831331, ex NSW). Summit of Mt Kosciusko, 15 Jan. 1951, *J.B. Cleland* (AD 97311132). Above Lake Albini, 1740 m, 20 Jan. 1951, *Johnson & Constable* (NSW 15808, CHR 72739, K). Alpine herb field near Mt Townsend, c. 7000 ft, 18 Jan. 1958, *A.B. Costin 0018* (CANB 46700). Lake Cootapatamba, granite rock area near small stream, 28 Feb. 1960, *M. Gray 4788* (CANB 114494). Mt Northcote-Mt Lee Saddle, fjeldmark at c. 2100 m in bog area, 11 Mar. 1974, *I.R. Telford 3706A* (CBG 055449), small (see below). Kosciusko, where Mt Kosciusko Summit Road crosses Spencer Creek, 2050 m, 31 Mar. 1978, *M.E. Lawrence 1397* (AD 98131070, voucher for chromosome count).

VICTORIA: Australian Alps, *s.d., F. Mueller* (MEL); Mt Baw Baw, 5000 ft, *s.d., F. Mueller* (MEL); both were initialed and cited by Bentham. Baw Baw, Mt Erica, 2 Jan. 1905, *H.B. Williamson* (MEL, Reference Collection, without varietal distinction). Mt Buffalo, 1350 m, *H.C. Stewart* (BRI 270950); valley E of the Horn, 27 Dec. 1951, *R. Melville 2659* (K). Bogong High Plains, Baker Spur Falls, 2 Feb. 1980, *R.J. Adair* (HO 59082); Watchbed Creek, 1640 m, near edge of fast-flowing creek, 10 Feb. 1982, *H. van Rees 314* (CANB 343121, HO 64361; both unusually robust, see above); c. 1 km E of Mt McKay, 1700-1750 m, 5 Jan. 1983, *A. Strid 22684* (CHR 397716, duplicates at B, C, M, MO, S, n.v.).

Senecio leptocarpus DC., Prodr. 6: 372 (1838); Hook.f., *Fl. Tasm.* 1: 222, Pl. 64-B (1856); Curtis, *Student's Fl. Tasm.* 2: 364 (1963); Harden, *Fl. N.S.W.* 3; 307 (1992). *S. pectinatus* DC. var. *pleiocephalus* Benth., *Fl. Austral.* 3: 665 (1867); non L. Rodway, *Tasm. Fl.* 93 (1903). *S. pectinatus* DC. var. *leptocarpus*, in L. Rodway, *Tasm. Fl.* 93 (1903).

TYPUS: Tasmania, Mt Wellington, *Gunn 268*. HOLOTYPUS: G-DC, on slip-tag: '268 [in pencil, rest in ink] / van Diemen / m^{r}. Gunn / env. par Lindley / 1834'; ISOTYPI seen: K ex Herb. Hook., 'Mt Wellington' [type of var. *pleiocephalus* Benth.]; K ex Herb. Benth.; NSW 153194; NSW s.n.; CGE in Herb. Lindley; CGE ex Herb. Lemann; OXF; others probably exist.

Perennial herb, scape somewhat decumbent or erect from a creeping rhizome, 8 to 45 cm tall. *Leaves* more or less crowded toward the base but continuing part way up the scapes, eventually reduced to bracts well below the inflorescence; bases narrowed, rarely subpetiolate; blades obovate to oblanceolate, coarsely toothed to (rarely) lobate;

upper surfaces glabrous, dark green, often appearing brownish and as if varnished when dried, *lower surfaces* glabrate to sparsely hairy, silvery, with veins very distinct; *lower bracts* of scape with exserted teeth, *distal bracts* denticulate to entire. *Capitula* pressed to 1-1.5 cm across, excluding rays; usually in flattened cymes of (2-)3-6(-8) heads on peduncles 1-3(-6) cm long, rarely a solitary capitulum at apex of scape; peduncles with short reddish multicellular hairs. *Phyllaries* 13-16, 6-8 mm long; *calycular bracteoles* 7-8, (3-)4-4.5 mm long, linear-lanceolate. *Rays* 12-13, yellow, to 9 mm long, 2-2.7 mm broad; *disc florets* numerous (40-50). *Cypselae* 2.5-4(-5) mm long, glabrate, pappus hairs shiny straw-colored, 5-7 mm long, very slender.

DISTRIBUTION

Widely distributed in the mountains and plateaux of Tasmania and frequently collected. Said by Curtis (1963: 364) to descend to sea-level in the southwest, but I have not yet seen a specimen so labelled. Also said by her to be in Victoria, and by Harden to be in New South Wales. I have seen very few authentic collections from the mainland. Most specimens so identified have proven to be of the alpine variety of *S. pinnatifolius*, readily distinguished by their smaller, more numerous, capitula and very different leaves (below).

DISCUSSION

To me, *Senecio leptocarpus* is a very distinct species, and I have great difficulty with Bentham's reduction of it to a variety of *S. pectinatus*. Specimens, even the rare [immature?] individuals with only one developed capitulum are readily recognisable by the distinctive two-tone leaf of unique shape. A careful search of such specimens will often reveal one or more tiny axillary capitular buds.

Candolle contrasted his *S. leptocarpus* with his *S. pectinatus*, with the former in all parts larger. The achene of the former he gave as '2-2 1/2 lin.' (4.5 mm) long and therefore twice longer than that of *S. pectinatus*, hence 'leptocarpus' or slender fruit. That measurement is at variance with my note about the holotype of *S. leptocarpus*, which gives the [immature remaining?] achenes as '2.2 mm long, velutinous', versus 'achenes all very immature, 2 mm long' for *S. pectinatus*. Other specimens I have seen which agree in all other particulars with *S. leptocarpus*, however, have cypselae 4 mm long or longer and slightly fusiform.

Bentham reduced *Senecio leptocarpus* DC. to a variety of *Senecio pectinatus* DC., thereby creating (under modern practice, at least) the autonym, *S. pectinatus var. pectinatus*. The new var. *pleiocephalus* was typified by citation of 'Mt Wellington, *Gunn*', based on a sheet with six specimens in the 'type' folder at Kew, ex Hb. (W. J.) Hook., so determined by Bentham. Interestingly, in open spaces near the bottom of the sheet are several careful drawings of six floral details which were included in Plate 64-B by J.D. Hooker. The righthand drawing, of a ligulate floret [shown as Fig. 1 on the plate], has the cypsela extending onto the upper part of the field label. Evidently the son used this sheet in his father's herbarium in preparing the *Flora Tasmaniae before* Bentham annotated it.

The point is that Bentham's variety was based on an isotype of *Gunn 268*, the holotype of *S. leptocarpus* DC.

It would have been better had Bentham used the basionym for his new combination. But this was only accomplished, incidentally and perhaps unintentionally, by Leonard Rodway in 1903, under *S. pectinatus* as 'var. *leptocarpus*', followed by 'Leaves 2-3 inches long, broadly spathulate, coarsely obtusely toothed. Flowers [capitula] 3-6 in a loosely terminal panicle.' This belated citation of the autonym seems to have been universally disregarded in the swing back to recognition of *S. leptocarpus* as a distinct species.

The confusion of *S. pectinatus* var. *pleiocephalus* Benth. with the very distinct pseudolautusoid taxon described as *S. pectinatus* var. *pleiocephalus* L. Rodway (non Benth.) is discussed below under *S. pinnatifolius* var. *pleiocephalus* (L. Rodway) Belcher.

SELECTED OTHER SPECIMENS EXAMINED

TASMANIA: Antaret. Exped. 1839-1843, *J. D. Hooker s. n., s. loc.* (K, P, UPS); MeQuarrie Harbour, Mt Sorell, 3000 ft., 31 Dec. 1846, *J. Milligan 759* (K, cited by Bentham as Mt Sorrel; MEL, 2 sheets); Mt La Perouse, *s. d., C. Stuart s. n.* (K; MEL, MEL ex herb. Sonder, both with material of *S. pectinatus* also); Mt de la Perouse, Mar. 1857, [*C. Stuart*] *1867, 1868, 1869* (all MEL, unmounted); Mt Field East, 4000 ft, Jan. 1869, *F. Mueller* (MEL); Hartz Mtn., Jan. 1901, *Lucas 1901* (NSW 153195, 153196); Mt Wellington, 2. Feb. 1932, *C.T. White 8377* (BRI 270948). Cradle Mt, 10 Feb. 1947, *K. Helms* (HO 14683); National Park, 7 Jan. 1949, *L.B. Moore* (CHR 66851); Mt Field National Park, slopes of Mt Mawson, 23 Jan. 1949, *N.T. Burbidge 3294* (CANB 19594); St. Valentine's Peak, 26 Jan. 1962, *M.E. Phillips* (CBG 017855); King William, 4000 ft, 10 Feb. 1973, *D.A. & A.V. Ratkowski 153* (CHR 258284, MO); Moonlight Ridge, 840 m, under subalpine shrubbery, *20 Mar. 1984, A.M. Buchanan 2962* (HO 88425).

NEW SOUTH WALES: Carruthers Peak, Mt Kosciusko area, 6500 ft, 16 Feb. 1972, *P.A. Keane 2* (NSW), determined originally as *S. lautus* subsp. *alpinus* Ali at NSW but redetermined by me in 1986 as *S. leptocarpus*.

Senecio papillosus F.Muell., in *Trans. Philos. Inst. Victoria* 2: 69 (by 30 Sept. 1857, non 1858; see below), in *J. Bot. Kew Gard. Misc.* 9: 301 (Oct. 1857); Hook. f., *Fl. Tasman.* 2: 365 (1859) [citation to Muell., *Trans. Phil. Soc. Vict.* 1855, p. 69 is in error]; Benth., *Fl. Austral.* 3: 664 (1867); L. Rodway, *Fl. Tasm.* 93 (1903); W. Curtis, *Student's Fl. Tasm.* 2: 364 (1963), *Endemic Fl. Tasm.* 4: 244 (1973). Illus. M. Stones, *Endemic Fl. Tasm.* 4: Pl. 77, No. 128 (1973).

TYPUS: Tasmania, Mount de Perouse. 1 Mar. 1857, *Stuart 1870* [number on packet], LECTOTYPUS **(here chosen)** MEL 40319; ISOLECTOTYPUS K ex Hb. Hook.; REMAINING SYNTYPI: 'Senecio papillosus / ferd. Muell. / Mount La Peyrouse / V. D. L. Stuart [scripsit C. Willhelmi, teste D. Sinkora] / B [in pencil, 'seen by Bentham']' (K, MEL 40318).

Perennial herb with horizontal or vertical rhizome bearing each year a terminal whorl of leaves and a solitary inflorescence. *Scape* 10-15 cm tall, with 4-6 linear-lanceolate short acute bracts, lowest one toothed. *Leaves* 15-20 in cmpact rosette, to 2 cm long, 0.9 cm broad, subpetiolate, thick, ovate to elliptical with revolute entire margins; upper leaf surfaces densely studded with clear short straight or curved multicellular hairs from tuberculate bases; lower surfaces slightly cobwebby, with raised venation. *Capitulum* solitary, 3-4 cm in diameter including rays; *phyllaries* 13, 9-10 mm long, slender; *calycular bracteoles* 5-8, (6-)8-9 ml long. *Rays* 15-20, spreading, 10-15 mm long, bright yellow. *Cypselae* not seen.

DISTRIBUTION

Curtis (1973: 244) gave the distribution as 'Recorded only near the summits of Adamson's Peak and Mount La Perouse.' The two more recent collections cited below extend the range slightly, but this is still a very localised taxon, even more so than *S. primulaefolius* (below).

DISCUSSION

Certain difficulties with dates of publication and typifications of this species and *Senecio primulaefolius* are discussed below, following the treatment of the latter taxon.

Bentham (1867: 664) commented that this species 'may possibly prove to be a variety of the New Zealand *S. bellidioides*, Hook. f.'. In as much as Nordenstam (1978: 30) has transferred the latter species to *Brachyglottis* because of its cacalioid features, I raised this point in an inquiry to Kew. C. Jeffrey responded as follows (pers. comm.): '*S. primulifolius* and *S. papillosus* show no 'cacalioid' features whatsoever and are typically senccionoid (balusterform collars, anticlinal not polarized endothecial thickenings, clcft stigmatic surface).' I therefore reject Bentham's suggestion. From the standpoint of gross morphology, a New Zealand species coming closer to *S. papillosus* is *S. lagopus*, but Nordenstam has also transferred that species to *Brachyglottis*.

OTHER SPECIMENS EXAMINED

TASMANIA: Adamson's Peak: saddle between Max and Adamson, 3850 ft, frequent on saddle skeletal soil, 21 Jan. 196l, *Whaite 228* (NSW); e. 3600 ft, alpine herb field on upper slope, 7 Feb. 1969, *I.R. Telford 2474* (CBG 027894); 2500 ft, 22 Jan. 1972, *D.A. & A.V. Ratkowsky 3* (K, cited for Pl. 128, *Endemic Flora of*

Tasmania); peaty flat, alt. c. 1050 m, between rocks, 23 Jan. 1972, *D.A. & A.V. Ratkowsky* (HO 52777). Mt Babs, summit plateau, 31 Jan. 1984, *R.G. Williams* (Herb. D.I. Morris, Hobart). Pindar's Peak, alt. c. 920 m, alpine heath and sedge land, 17 Feb. 1986, *D. Zigler* (HO 97419).

Senecio primulaefolius F. Muell., in *Trans. Philos. Inst. Victoria* 2: 69 (by 30 Sept. 1857, teste H.I. Aston), in *J. Bot. Kew Gard. Misc.* 9: 300-1 (Oct. 1857) [both as *S. primulifolius*]; Hook. f., *Fl. Tasm.* 2: 365 (1859). *Senecio primulifolius* F. Muell. in Benth., *Fl. Austral.* 3: 664 (1867); L. Rodway, *Fl. Tasm.* 93 (1903); Curtis, *Student's Fl. Tasm.* 2: 364 (1963); Curtis, *Endemic Fl. Tasm.* 4: 244 (1973). Illustration: M. Stones, *Endemic Fl. Tasm.* 4: Pl.77, No. 129 (1973).

LECTOTYPUS (**here chosen**): Tasmania, Mt La Perouse, 1 Mar. 1857, *C. Stuart 1871*, K ex Hb. W. J. Hook., upper right specimen, ruled off from rest of sheet by pencilled line; ISOLECTOTYPI: MEL 40321 & 40322.

Note: I prefer a specimen retained by Mueller at MEL as representing his type, but this case presents special difficulties. Neither of the Stuart specimens of this taxon at MEL now has a capitulum, nor is there a packet on either sheet, as there is for the specimen at Kew. There can be no question that these MEL specimens agree vegetatively with the lectotype and are indeed '*S. primulifolius* / F. M.' as penciled in Stuart's script (teste D. Sinkora in litt.). Both are initialed 'B', seen by Bentham.

Perennial herb with horizontal rhizome, bearing each year an apical whorl of a few leaves and 1-2(-3) inflorescences. *Scapes* erect, 10-15(-30) cm. *Basal leaves* short- to long-petiolate, blades ovate-cordate and irregularly crenate or sinuate; upper surfaces glabrate or sparsely hairy, with sunken reticulate venation, lower surfaces purplish and glabrous or sparsely cobwebby; *bracts* 4-5, sessile and clasping, variable in size and shape, the lowest oblanceolate. *Capitula* (1-)2-4 per scape, 2.5-4 cm in diamter (including rays), peduncles 4.5-5.5 cm long. *Phyllaries* 13-21, 7-8(-10) mm long, acuminate. *Calycular bracteoles* numerous, to 6 mm long; phyllaries and bracteoles densely cottony-hairy. *Rays* 13-15 or more, golden yellow, to 2 cm long, 5 mm broad. *Cypsela* (immature) 2.5-3.5 mm long, glabrous, cylindrical with prominent basal annulus.

DISTRIBUTION AND CONSERVATION STATUS

Tasmania, southwestern District, Huon District [?]. Curtis (1973: 224) stated: 'Recorded only from Mt La. Perouse at an altitude of about 3000 feet'. Recent field work has slightly expanded the known distribution of this very localized and rarely collected endemic, represented in very few of all the herbaria which I have examined. In Leigh *et al.* (1981: 52) both it and *S. papillosus* are listed as risk code '3RC' [defined, p. 10]; i.e., '[3] range over 100 km, [R] rare, [C] known in a park or reserve'. Of the two, *S. primulaefolius* appears to be a little less restricted, but the ranges of both seem not be as great as indicated by Leigh *et al.* Further field work should clarify this.

COMMENT ON SPELLING OF SPECIFIC EPITHET

Mueller published this species as *Senecio primulifolius*, and this spelling has been followed in every publication in which it occurs that I have seen, except for J.D. Hooker's Addendum to his *Flora of Tasmania*. A careful consideration of the 'Tokyo Code' (Greuther, 1994) supports Hooker's spelling. Art. 60.8 (p. 74) [Art. 73.8 in the Berlin Code of 1988] states: 'The use of a compounding form contrary to Rec. 60G in an adjectival epithet is treated as an error to be corrected.' Rec. 60Gl (p. 78) distinguishes between (a) a true compound and (b) a pseudocompound, defined as a phrase treated as if it were a single compound word. In such a pseudocompound, a noun or adjective in a non-final position appears as a word with a case ending, not a modified stem. An example cited is *cannaefolius* (leaf of *Canna*). By analogy, 'leaf of *Primula*' [also a feminine generic name] should be '*primulaefolius*', as adopted here.

OTHER SPECIMENS EXAMINED

TASMANIA: 'Foot of Mount De La Perouse', *s.d., s.n.*, coll.?, Hb. Oldfield (K ex Hb. W.J. Hook., on same sheet as the lectotype); Mt La Perouse, Dec. 1897, *L. Rodway s.n.* (NSW 153197, HO 14844); Mt La Perouse,

Dec. *s. anno, Lucas s.n.* (NSW 153198); Reservoir Lake [La Perouse], Dec. 1898, *F. A. Rodway 5105* (NSW 153199); Mt Counsel [N of Cox Bight], alt. 2400', 19 Dec. 1954, *M. Davis 1449* (MEL 40320, without capitulum but unmistakable; most southwesterly specimen seen by me); Moonlight Flats, La Perouse, [1972], *Dr. & Mrs. Ratkowski s.n.* (K, basis for M. Stones' Pl. 77, No. 129, l.c.); 'Hill 1 (Huon [District?])', 15 Feb. 1977, *M. Allen s.n.* (Herb. D.I. Morris, Hobart). Southwest District, Moonlight Ridge, alt. 850 m, under subalpine shrubbery, 20 Mar. 1984, *A.M. Buchanan 2961* (HO 88424); ibid., Reservoir Lake, under ... subalpine shrubbery, 21 Mar. 1984, *A.M. Buchanan 2987* (HO 88357).

Problems peculiar to *Senecio primulaefolius* and *Senecio papillosus*

The first problem concerns the dates of publication of these two taxa. The conventional date for Vol. 2 of the *Transactions of the Philosophical Institute of Victoria* is given as 1858, but Aston (1984: Table 1, entry F [p. 283] & p. 286) has shown that this is not entirely true. According to her findings, Part 1 of Vol. 2, pp. 1-92, was published between the 23rd and 30th of September, 1857. This thus antedates the issuance in October, 1857 (Staffleu & Cowan, 1979: 299), of that part of Vol. 9 of Hooker's *Journal* containing pp. 289-320, including Mueller's descriptions of four new species from Tasmania.

Was Bentham aware of this earlier date for the first part of Vol. 2 of the *Transactions*? That a copy may have been sent to Kew is suggested by the fact that Bentham cited '*F. Muell. in Trans. Phil. Inst. Vict.* ii. 69' as the first reference under *S. papillosus*, and the only one for *S. primulifolius*. This is contrary to the later entries in *Index Kewensis* (Jackson, 1895, 2: 378 & 379) for both of these species as 'Hook. Kew Journ. IX (1857)'. These matters could perhaps be clarified by a diligent search in the library at Kew, which I have not been able to make.

A second question, about the typification of both of these taxa, is raised by this reversal of the sequence of publication. In his article in the *Proceedings*, Muller gave, for the former: 'On Mount Laperouse, south-western Tasmania. C. Stuart, A. Oldfield.', and for the latter: On Mount Lapérouse, Van Diemen's Land. C. Stuart, A. Oldfield.' Are there specimens collected by Oldfield that should be included as syntypes?

That Augustus Frederick Oldfield collected in Tasmania and elsewhere in Australia is not in question. Just when he did is not so clear. Vegter (1983: 619) gives: '*Herbarium*: K (plants from Tasmania, New South Wales, & Western Australia, coll. 1858-59μ and 'Tasmania (coll. ± 1858)'. There are some specimens of other species of *Senecio* [such as the type specimen of *S. lencoglossus* F. Muell. from Harvey River, W.A., (MEL, PERTH)], clearly collected by Oldfield but without date. But I have found no specimens of either of these two alpine species clearly laid in with his name.

The only clue I have found is a label on the lower left corner of the lectotype sheet of *S. primulaefolius* at Kew, applied to the four specimens ruled off from the Stuart type. This reads: '*Hb.* [italic mine] Oldfield / Foot (sic!) of Mt De La Perouse, Tasmania'. It is not explicit that the specimens were collected by Oldfield; they may have been given to him by Stuart. On the other hand, they may have actually been collected by Oldfield subsequent to the publication of this taxon, perhaps in 1858, and forwarded to W.J. Hooker. None of these alternatives, however, would account for Mueller's inclusion of Oldfield in the earlier paper.

In the absence of any specimen at either K or MEL of *S. papillosus* or of *S. primulaefolius* clearly identifiable as actually collected by Oldfield, I have to conclude that no Oldfield syntype of either taxon now exists. Mueller's inclusion of Oldfield's name in the Proceedings remains unexplained.

Even more puzzling is the fact that Bentham cited 'Mount Lapeyrouse, *Oldfield*' as his *only* specimens for *S. papillosus* and *S. primulifolius*, and as one of three cited from Tasmania for *S. pectinatus* [typical var.], and as one of three cited for var. *pleiocephalus*. I find it very strange that he made no mention of any Stuart specimen in connection with these scapose alpine taxa, despite having initialled Stuart specimens from both W. J. Hooker's and Mueller's herbaria as seen by himself.

The peculiar spelling of 'Mount Lapeyrouse' can be traced, as suggested by Helen Aston (*in litt.*), to two Stuart specimens from Mueller's herbarium [now MEL 40318 and 40322]. These are respectively labelled, in Carl Wilhelmi's handwriting, as from 'Mount la Peyrouse' and from 'Mount Lapćyrouse', with the 'y' [later?] struck through

on both. Both are initialled as seen by Bentham. Why he would attribute them to Oldfield rather than to Stuart is unclear.

In the *Proceedings of the Philosophical Institute* both taxa were described only in English, a part of a lengthy contribution [pp. 62-77] entitled 'New Australian Plants' from various parts of Australia including Tasmania. In the very slightly later brief paper in Hooker's *Journal*, all the text is in Latin. After the description of the former species he gave: 'Hab. In monte La Perouse Tasmaniae austro-occidentalis alpinae detexit *Stuart*.', followed by a lengthy paragraph of additional information not in the English version. Similarly, for the latter taxon he gave: 'Hab. In monte La Perouse Tasmaniae, *Stuart*.', again followed by additional details. In both cases, obviously, only the one collector is cited.

It is my belief that Mueller intended this much more scholarly and sharply focused paper to be the place of original publication and shipped it off to W.J. Hooker in that expectation, little dreaming that it would be delayed past the premature issue of the more general article in the *Procedings*. This latter article also included on the same page the description, only in English, of *S. drymophilus* F. Muell., a *Gynura* from SE Queensland [cf. Belcher 1989: 533, erroneously as 1858]. Indeed, as I look over my copies of Mueller's descriptions of new taxa of *Senecio*, I find (in addition to that of *S. pectinatus* var. *ochroleucus*) just one other instance of a description only in English, that of *S. gregorii* [*Othonna gregorii* (F. Muell.) C. Jeffrey in *Kew Bulletin* 41: 876 (1986)].

Alpine state of *Senecio pinnatifolius* A. Rich. *s. lat.*

Senecio pinnatifolius A. Rich. var. ***pleiocephalus*** (L. Rodway) Belcher *comb. nov.*
Senecio pectinatus DC. var. *pleiocephalus* L. Rodway, *Tasm. Flora* 93 (1903); *non* Benth., *Fl. Austral.* 3: 665 (1867). '[*Senecio*] *pectinatus* DC. l.c. 372 / var. *pleiocephalus* [non] Benth. Fl. iii 665', Maiden & Betche, *Census N.S.W. Plants* 204 (1916), *nom. nud.*, per specimens so determined. *Senecio lautus* G. Forst. ex Willd. subsp. *alpinus* Ali, *Aust. J. Bot.* 17: 167 & Fig. 3 (1969); Willis, *Handbook Pl. Victoria* 2: 751 (1972).

HOLOTYPUS: Victoria, Mt Buffalo National Park, on SW margin of Lake Catani, c. 4500 ft, 21 Feb. 1963, *J. H. Willis s.n.* (MEL 666007).

LECTOTYPUS (**here chosen**): Tasmania, Mt Ironstone, 'De[c.] of [18] 99', *L. Rodway s.n.* (HO 14689, excluding specimen on extreme right, which is *S. pectinatus* var. *pectinatus*).

Perennial herb or subshrub, typically much branched both below and in the inflorescence, **occasionally ascendant and subscapose or scapose**; *lowest leaves* oblanceolate and dentate, sometimes petiolate; *mid-cauline leaves* pinnatifid to pinnatisect, lobes 2-4(-5) on either side and alternate to subopposite and lobulate or toothed, **sometimes reduced to lobulate bracts**, all divisions with enlarged callose apices. *Inflorescence* of several to numerous elongate or short branches each ending in 3-5 capitula, rarely fewer; *peduncles* with multicellular hairs terminating in wisps; *involucres* cylindrical; *phyllaries* 13, (3-)3.5-4.5 mm long and strongly bi-ribbed; *calycular bracteoles* whorled at apex of peduncle just below the receptacle, numerous, ciliolate, lanceolate to broadly triangular, 2-2.5 mm long, the tips atropurpureous. *Denuded receptacles* 3.5-4 mm in diameter. *Marginal florets* 11-13, ligules yellow, 5-6(-7.5) mm long, 1.5-2 mm broad; *disc florets* yellow, c. 40; *cypselas* c. 3 mm long, hairy or not. Fig. 2 illustrates a scapose specimen, *R. & R. Belcher 996*. Note: This description is greatly expanded from the very cryptic one given by Ali and the brief one by Rodway (below). Features confined to subscapose and scapose specimens are in boldface type.

DISTRIBUTION
Alpine and subalpine mountains and plateaux of Australian Capital Territory, SE New South Wales, NE Victoria, and Tasmania; subscapose and scapose specimens more rare than bushy ones.

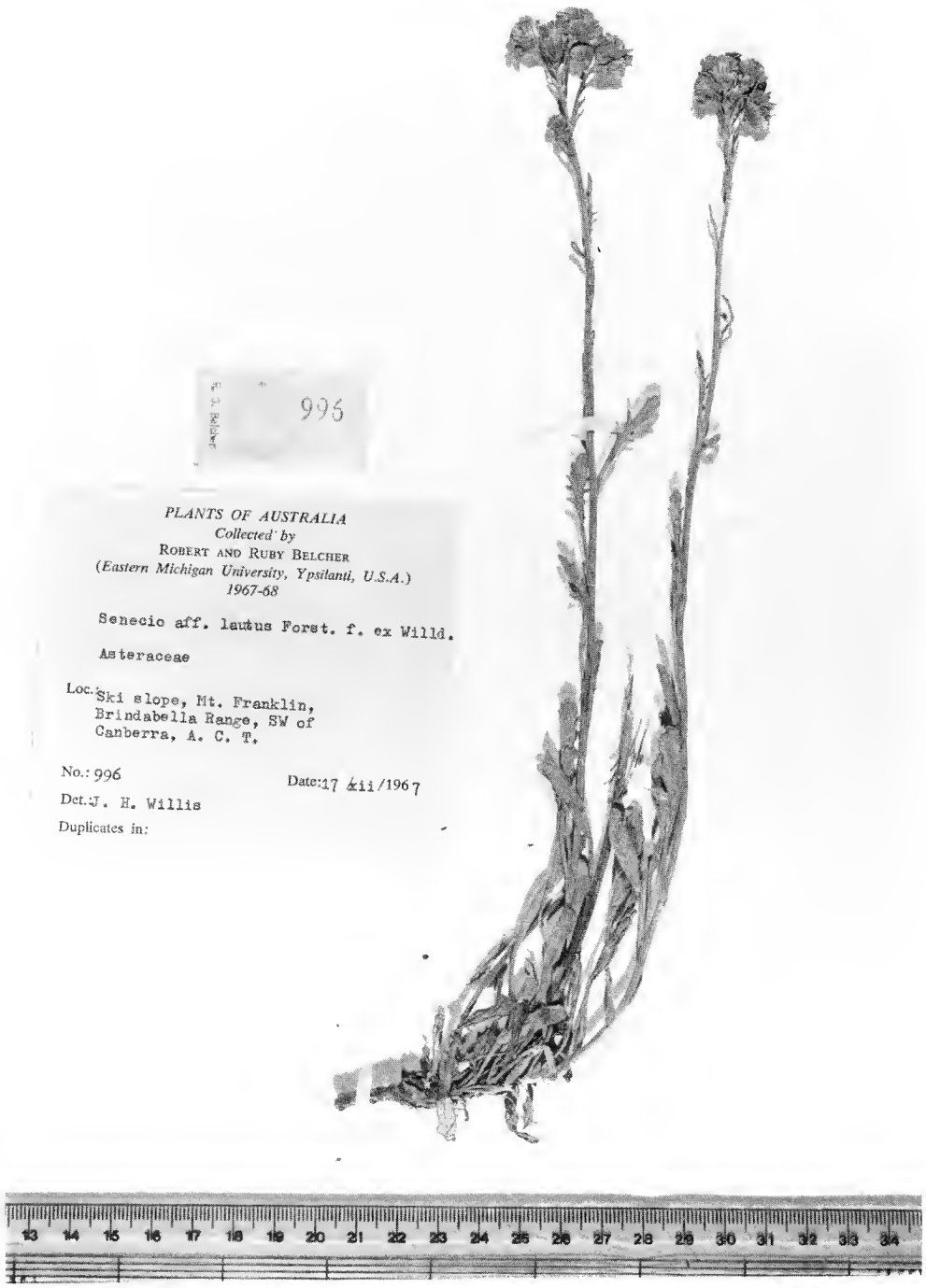

Fig. 2. Scapose specimen of *Senecio pinnatifolius* A. Rich. var. *pleiocephalus* (L. Rodway) Belcher. Apex of rhizome with subpetiolate leaves and scapes with reduced pinnatilobate bracts; from *R. & R. Belcher 996*, Mt Franklin, A.C.T. (EMC).

DISCUSSION

Rodway described his var. *pleiocephalus* as: 'Tufted, stems numerous. Leaves spathulate and lobed, as in the type, but more dispersed on the stems, about 1 inch long. Stems 6-9 inches. Flowers [capitula] smaller than in the type [of *S. pectinatus*], in loose terminal panicle. Ironstone Mountain and western mountains. But for the peculiar outer bracts of the involucre, it would pass for a form of *S. lautus*.'

The lectotype specimen, HO 14689, I found at Hobart in a folder labelled '*Senecio leptocarpus*' and containing five other collections all clearly of that taxon. The sixth was labelled 'L. Rodway [s.n.] Dec of 99 Ironstone Mt / Senecio ~~lautus var.~~ pectinatus var. [in pencil]'. It also had an unsigned determinavit slip: 'Senecio leptocarpus / March 1976'. Although this sheet does not carry the varietal epithet 'pleiocephalus', the left and center specimens agree fully with Rodway's description of that variety. The deletion of 'lautus var.' on the label is undoubtedly reflected in his comment, above, concerning the 'peculiar outer bracts of the involucre'.

Actually, these bracteoles are in fact typical of the Australian pseudolatusoid material formerly included in *Senecio lautus*! I have been unable to establish why he made this comment. Had he been comparing the Ironstone Mt specimens (L & C) with authentic material of *S. lautus* from New Zealand, that comment would have been fully justified. But the only specimen of *S.lautus* that I logged at HO was collected in 1967. His description of these features under *S. lautus* (pp. 93-4) reads: 'The inner bracts [phyllaries] all equal, the outer al[l] short and / clothing [undefined] the base of the involucre.' This seems to fit those two specimens.

It has taken me nearly a decade to realise that Rodway was actually the first to name and describe this alpine taxon, with leaves so different in detail from the other pseudolautusoid material, and that his name has clear priority at the varietal rank (Greuter *et al.*, 1994: 16, Art. 11.4). If this taxon were retained at the subspecies rank, *alpinus* would have priority.

Although the Rodway description and specimens are of the scapose state, this state grades without any discontinuity through the subscapose states to the more common non-scapose material reresented by the holotype of subsp. *alpinus* Ali. Thus I expanded the above description to include all these phases.

I have (Belcher, 1993) contended that specimens of the pseudolautusoid complex so common in Australia are specifically distinct from *Senecio lautus* G. Forst. ex Willd. of New Zealand. I later (Belcher, 1994) analysed and illustrated the several names applied to these Australian plants by Richard and by Candolle. Further study has led me to consolidate these classical names as varieties of *Senecio pinnatifolius* A. Rich. s. lat., and also to reduce all the other Australian subspecies of *Senecio lautus* described by Ali to varietal status (Belcher in preparation).

SELECTED SCAPOSE AND SUBSCAPOSE SPECIMENS EXAMINED

AUSTRALIAN CAPITAL TERRITORY: Brindabella Range, Mt Franklin ski slope, 17 Dec. 1967, *R. & R. Belcher 996*, (EMC, 3 specimens, all scapose); *ibid. 997* (EMC, 5 specimens, all scapose).

NEW SOUTH WALES: Pretty Point, Mt Kosciusko, Jan. 1899, *J.H. Maiden & W. Forsyth s.n.* (AK 77541 ex NSW; K; NSW 55512; all scapose); Mount Kosciusko National Park, c. 4 1/2 miles [7.2 km] below Kosciusko Peak along main road, 14 Jan. 1962, *T.C. Chambers & S I. Ali s.n.* (MEL 1552932, 5 pieces, very pubescent, subscapose).

VICTORIA: Bogong High Plains just E of Rocky Valley storage, 1620-1700 m, grazed subalpine meadows, partly swampy, 15 Jan. 1983, *A. Strid 22076* (G 245696, subscapose; duplicates to B, C, CHR, M, MO, S, n.v.).

TASMANIA: Mt Barrow, talus slope below summit, 6 Feb. 1968, *R. & R. Belcher 1353* (EMC, 6 specimens, all scapose, retaining stumps of previuous inflorescenees); Mt Field National Park, 2.5 miles [4 km] from Lake Dobson, spreading clump 1 ft [30 cm] in diameter, height to 15 in [38 cm], 17 Feb. 1968, *R. & R. Belcher 1502* (EMC, scapose whole plants); Ouse River S of Prince Albert's Throne, alt. 1200 m, 16 Mar. 1984, *A. Moscal 7011* (HO 83962, scapose); Lake Ada, Cent. Highlands Dist., alt. 1150 m, 20 Jan. 1985, *W.M. Curtis s.n.* (HO 95285, subscapose); Mt Wellington, just below the Organ Pipes, 6 Jan. 1987, *R.O. Belcher 2680* (EMC, subscapose).

Confusion over '*Senecio pectinatus* var. *pleiocephalus* Benth.'

Collections of mainland alpine taxa of *Senecio* became more numerous around 1890; some of these were of scapose pseudolautusoid radiates with multiple capitula. An

example is 'Mt Kosiusko, Pretty Point, Jan. 1899, *J.H. Maiden & W. Forsyth s.n.* (AK 77541, K, NSW 55512). This collection was identified [by Maiden?] as '*Senecio pectinatus* var. *pleiocephalus* Benth.' [non. L. Rodway], as were several other scapose and some non-scapose specimens. This eventually led to the listing of Bentham's name, without description, in *A Census of New South Wales Plants* (Maiden & Betche, 1916: 204), and later to the inclusion of *S. leptocarpus* in the mainland flora by some. Yet most mainland specimens thus identified under either name which I have examined are not *S. leptocarpus* but *S. pinnatifolius* var. *pleiocephalus* L. Rodway (non Benth.)! Indeed, Ali correctly cited NSW 55512 among his specimens of *S. lautus* subsp. *alpinus* (1969: 168).

I believe this confusion came about as a result of the discovery of these scapose radiates such as the Pretty Point specimens cited above. Mainland scapose radiates with a single large capitulum had already been included by J.D. Hooker and by Bentham in *S. pectinatus* (my var. *major*). Scapose radiates with multiple but smaller capitula must have semed to Maiden to fit Bentham's decription of *S. pectinatus* var. *pleiocephalus* as 'Flower heads rather smaller, 3 to 5 together in a loose terminal corymb.' The dificulty was in the lack of precision in 'rather smaller'. The mainland scapose specimens with multiple capitula had heads *much* smaller than the large ones of var. *major* and those of *S. leptocarpus*.

Acknowledgements

The unstinting assistance of curatorial staffs of all the herbaria I visited in 1984 and in 1986-7 in connection with this study is greatly appreciated, as is the patience of the herbaria from which I have obtained loans of specimens, the return of which is long overdue! Special thanks are due to Helen Aston, Don Foreman, and Doris Sinkora (MEL); A.T. Orchard (then at HO, now ABRS); and C. Jeffrey (K). Margaret Lawrence as referee made many helpful suggestions for improving and shortening this still over-long treatment. Once again I thank Lynn Lesko for assistance with the illustrations.

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Three new Victorian species related to *Eucalyptus aromaphloia* L.D.Pryor & J.H.Willis and notes on the polymorphic nature of that species

K. Rule

6 Regal Court, Vermont South, 3133, Victoria, Australia.

ABSTRACT

Eucalyptus fulgens from West Gippsland, *Eucalyptus sabulosa* from the Wimmera region (including the Grampian Ranges) and *Eucalyptus splendens* from the Portland area in south-western Victoria are described and comments regarding the affinities, distribution and conservation status of each are given. Of the new taxa *Eucalyptus splendens* has a very restricted distribution and has been assigned a specific code regarding its conservation status. The polymorphic nature of *Eucalyptus aromaphloia* is also discussed in the accompanying notes and several morphological forms within that species are identified.

Introduction

Populations of smallish, rough-barked trees with seven-flowered inflorescences, scarred buds (the outer operculum is shed early in bud development) and smallish, sub-globular fruits, namely forms of *Eucalyptus viminalis* Labill., *E. cephalocarpa* Blakely and *E. aromaphloia* L.D.Pryor & J.H.Willis, are common in south-eastern Australia, particularly throughout southern Victoria. These have been sources of considerable confusion to observers of *Eucalyptus* at many levels. Despite such adult convergence, each group is markedly distinctive in its seedling characters. The juvenile leaves of *E. viminalis* are characteristically green, lanceolate, sessile, amplexicaul and opposite for numerous pairs, those of *E. cephalocarpa* are greyish and copiously waxy, orbicular, sessile, amplexicaul and opposite and the juvenile leaves of *E. aromaphloia* are elliptical, blue-green or grey-green, disjunct and usually shortly petiolate.

Even more confusing, however, is the level of diversity of forms traditionally included under *E. aromaphloia*. Such diversity, in most cases, is subtle to the extent that the segregation of the many different entities depends largely on differences in pre-adult characters. This study has been concerned with resolving taxonomic problems within the complex through the use of seedling trials. The value of such investigations cannot be underestimated as, too often, differences in seedlings are not always apparent in the field. Most certainly, such differences are rarely available in herbaria specimens due to the lack of seedling materials (see Table 1).

The description of *E. aromaphloia* by Pryor and Willis (1954) was the first attempt to resolve the problem of these smallish, rough-barked trees. Its distinctive features were given as alternate, glaucous, elliptical or ovate, sessile or sub-sessile juvenile leaves and a markedly aromatic bark. The distribution was given as central and western Victoria and lower south-east South Australia. The authors also suggested that populations occurring in central Gippsland were probably of the new species.
Furthermore, particular note was given to a gradation in juvenile leaf width with broadest widths occurring in the east, for example at Creswick, to narrowest in the west, for example at Stawell.

In 1962 *E. corticosa* L.A.S.Johnson was erected to accommodate populations of a form of *E. aromaphloia* occurring in three markedly disjunct localities on sandy soils rather than heavy, poorly-drained soils, in the case of *E. aromaphloia*. The selected type population was in the vicinity of Rylstone near Sydney and the others were given as occurring near the New South Wales-Victorian border to the south of Eden and

TABLE 1. COMPARISONS OF SEEDLING MORPHOLOGIES OF *EUCALYPTUS AROMAPHLOIA* AND ITS RELATIVES

Character	*Eucalyptus aromaphloia*	*Eucalyptus fulgens*	*Eucalyptus sabulosa*	*Eucalyptus splendens*	*Eucalyptus iguorabilis*	*Eucalyptus corticosa*
Nodes	moderately crowded to relatively sparse	relatively sparse	relatively crowded	moderately crowded	moderately crowded	moderately crowded
Growth tips	waxy	non-waxy	non-waxy	non-waxy	non-waxy	non-waxy
Juvenile leaf colour	dull or rarely sub-lustrous, grey-green or blue-green	dull, pale green or slightly blue-green, becoming sub-lustrous in advanced juvenility in some populations	lustrous green:	lustrous green	dull, grey-green	dull or sub-lustrous, blue-green
Juvenile leaf shape	narrow to broad elliptical or elliptical-ovate (narrow-leaved forms becoming falcate in advanced juvenility) or linear-oblong and markedly falcate	broad-lanceolate, ovate-lanceolate or ovate, becoming falcate in advanced juvenility	linear, markedly falcate	narrow-lanceolate or lanceolate then ovate-lanceolate in advanced juvenility, non-falcate	lanceolate or ovate-lanceolate, becoming falcate in advanced juvenility	narrow-lanceolate, non-falcate
Juvenile leaf size	3–7 x 0.6–4 cm	4–8 x 1.8–3.5 cm	4–9 x 0.5–1 cm	6–10 x 1–2.2 cm	5–8 x 1.2–2.5 cm	4–8 x 1–1.8 cm
Stem cross-section	round or less often square	round or square	round	square and finely ridged	round	round
Petiole development	sessile for 8–15 pairs in most forms	sessile for 8–10 pairs	sessile for 20 or more pairs	sessile for at least 15 pairs	sessile for 8–12 pairs	sessile for 12–18 pairs
Petiole length	to 5 mm	to 1 cm	to 4 mm	to 4 mm	to 6 mm	to 5 mm
Disjunction	in most forms, opposite for 8–15 pairs then irregularly opposite, sub-opposite or alternate for numerous pairs	regularly alternate after 8–10 pairs	variable, but opposite for at least 20 pairs then irregularly opposite, sub-opposite or alternate for numerous pairs	opposite for 10–18 pairs then irregularly sub-opposite or alternate for numerous pairs	opposite for 8–12 pairs then regularly alternate	opposite for 12–18 pairs then regularly alternate

in Victoria's Grampian Ranges in the vicinity of Hall's Gap. Such populations were distinguished from *E. aromaphloia* by their relatively narrow, blue-green juvenile leaves, dullish 'ash-green' or light green adult leaves and appreciably pedicellate fruits (although it was noted by the author that the Grampians populations featured greener foliage and relatively short pedicels). However, Pryor and Johnson (1971) and Willis (1973) recommended that the species be included with *E. aromaphloia* on the basis that its morphology was not consistently separable from that species.

The identity of variable populations of seven-flowered, rough-barked trees in south-west Victoria and south-east South Australia attributed, in part, to *E. aromaphloia* by Pryor and Willis became the subject of considerable controversy. They, and Pryor again in 1955, suggested extensive hybridism involving *E. viminalis* and *E. aromaphloia*. Eventually, *E. viminalis* Labill. subsp. *cygnetensis* Boomsma was described in 1980 and, to a large extent, its treatment eliminated the confusion. Later, Boomsma (1981), in his account of South Australian eucalypts, noted that, despite a thorough search for *E. aromaphloia*, it could not be located in either south-west Victoria or lower south-east South Australia. Further, Chappill and Ladiges (1986), who studied the species and who advanced our understanding of it considerably, supported Boomsma when they found no evidence of intergradation with *E. viminalis* in western Victoria. They too suggested that *E. viminalis* subsp. *cygnetensis* accounted for the extensive occurrence of rough-barked, seven-flowered trees in the region.

In their study Chappill and Ladiges gave evidence to support the resurrection of *E. corticosa* as a species, whose distinctive features were said to include markedly glandular, relatively thin adult leaves (almost twice the density of oil glands found in some Grampians populations that had been included under *E. corticosa* by Johnson), relatively small fruits and non-glaucous, non-falcate, linear-lanceolate juvenile leaves. However, they suggested that it was confined to the type locality near Rylstone. From their evidence they also concluded that *E. aromaphloia* in its original sense contained two additional taxa which could be segregated both morphologically and geographically. Although the distribution of the typical form was given as west-central Victoria, they identified a western form (west of the Grampians Mt. William Range and extending to the centre of the Little Desert) with linear, prominently falcate, sessile, non-glaucous juvenile leaves and with moderately glandular adult leaves and an eastern form (extending from west Gippsland to south-east New South Wales) with broad-lanceolate, petiolate, non-glaucous juveniles. The western form incorporated, in part, the Grampian Ranges segment of Johnson's *E. corticosa* whereas the eastern form included the Eden populations.

E. ignorabilis L.A.S.Johnson and K.D.Hill was described in 1991 to accommodate dull-leaved populations occurring on sandy soils along water courses in central and east Gippsland and in adjacent areas of south-east New South Wales. This new taxon included segments of Chappill and Ladiges' eastern taxon, but not west Gippsland populations with a distinctive lustrous canopy. However, during the course of this study it became apparent that the distribution of *E. ignorabilis* provided by the authors included populations of a form of *E. cephalocarpa* with markedly similar adult features and also with a preference for sandy soils. Despite this, the two are clearly separable in their juvenile leaves with those of *E. ignorabilis* being lanceolate or ovate-lanceolate, alternate and petiolate and those of the other being typical of *E. cephalocarpa*. Differences between the two in bud morphology were also observed, those of *E. ignorabilis* being regularly pedicellate and non-waxy and those of the other taxon being sessile and most often lightly waxy. This study further revealed that *E. ignorabilis* consists of two relatively restricted, markedly disjunct forms. The typical form occurs on extremely elevated sites in shale derivatives in the vicinity of Walhalla, whilst eastern populations occur on sandy soils near water courses in far east Gippsland and adjacent areas of New South Wales.

In summary, the region of Gippsland and adjacent areas of south-east New South Wales contains three species with similar adult features. In addition to the ecotypes of *E. ignorabilis*, there is a form of *E. cephalocarpa* occupying the intervening regions but overlaps with the eastern form of *E. ignorabilis*. *Eucalyptus ignorabilis* does not extend

into west Gippsland beyond the Latrobe Valley, as some Victorian observers have assumed, but is replaced by the closely related, lustrous-leaved third species which favours heavy soils on hilly terrain.

Two other relatives of *E. aromaphloia* are described as new species. The first, which consists of numerous small populations occurring throughout the Wimmera region, represents Chappill and Ladiges' western taxon. The second, which has a very restricted distribution, was overlooked by previous researchers. It occurs near Portland in south-west Victoria and features seedlings with lustrous, juvenile leaves and squared, finely ridged stems.

The study also examined the variable nature of *E. aromaphloia* and a mosaic of subtly different forms has been identified. In the context of this study, all these forms are considered to belong to a single, extremely polymorphic species. In the accompanying notes aspects of their morphologies and their distributions are briefly discussed.

Taxonomy

1. ***Eucalyptus fulgens*** K.Rule *sp. nov.*

Eucalypto ignorabili L.A.S.Johnson & K.D.Hill affinis, foliis juvenilibus majoribus viridibus pallidis, foliis adultis nitido-viridibus, cortice crassa subfibrosa sulcata profunde differt.

HOLOTYPUS: 0.9 km along Red Hill Road from the intersection of Albers and Manestar roads, Upper Beaconsfield, Victoria, 38°02'S, 145°23'E, 20 June 1994, *K. Rule 9464* (MEL).

Small, spreading trees to 15 m tall. *Bark* grey-brown, sub-fibrous, often deeply furrowed on trunk and major branches with thick slabs and strips; basal bark with loose, often crusty chunks; minor branches smooth, light brown, with old bark decorticating in short, brownish ribbons. *Seedling leaves* ovate-elliptical, pale green, sub-sessile, decussate. *Juvenile leaves* broad-lanceolate, ovate-lanceolate or ovate, sessile then shortly petiolate by 8-10 nodes and becoming disjunct (sub-opposite for a few pairs then regularly alternate) at the same stage, pale green or slightly blue-green, dull but may become slightly lustrous in advanced juvenility, slightly discolorous, acuminate, glandular, 4-8 x 1.8-3.5 cm; petioles to 10 mm long; venation visible but not conspicuous; growth tips lustrous; nodes relatively sparse; seedling stems square or round in section but non-ridged. Intermediate leaves lanceolate or broadly lanceolate, sometimes falcate, longer than juvenile leaves, sub-lustrous or lustrous, green or slightly blue-green, pendulous. *Adult leaves* lanceolate, falcate, lustrous, green, concolorous, glandular with numerous island glands, acuminate, 12-25 x 1.5-3 cm; petioles 1.4-2.5 cm long; venation moderately reticulate; intramarginal veins 1.5-2.5 mm from margin. *Inflorescences* simple, axillary, 7-flowered; peduncles slender, terete, to 1.1 cm long. *Floral buds* ovoid or clavate, scarred, pedicellate, to 6 x 3 mm; pedicels as long as buds; opercula conical, as long as hypanthia; anthers irregularly inflexed, oblong, dehiscing through longitudinal slits; filaments white. *Fruits* sub-globular, pedicellate, to 6 x 5 mm; discs ascending; valves slightly exerted; locules 3 or 4; pedicels 2-4 mm long. *Fertile seeds* black, irregular in shape, slightly flattened, lacunose.

FLOWERING PERIOD

Autumn.

DISTRIBUTION

The populations are sporadic and occur in west Gippsland from the Latrobe Valley to the Yarra Valley (Fig. 1). The preferred habitat is heavy soils of sandstone origin on ridges and slopes. The annual rainfall across the range exceeds 800 mm with a winter maximum.

CONSERVATION STATUS

The region in which *E. fulgens* occurs has been subjected to extensive clearing particularly for dairy farming. Although reduced to sporadic populations, the species is still abundant in some forested areas that have escaped clearing. It is not regarded as endangered.

ASSOCIATED SPECIES

The species generally grows in pure stands may mix with several other species. Included are *E. radiata* Sieber ex DC., *E. consideniana* Maiden, *E. ovata* Labill., *E. pryoriana* L.A.S.Johnson, *E. cephalocarpa E. conspicua* L.A.S.Johnson & K.D.Hill, *E. obliqua* L'Herit. and *E. dives* Sehauer.

ETYMOLOGY

The speeifie epithet is derived from Latin and alludes to the lustrous appearanee of the adult leaves.

DISCUSSION

Eucalyptus fulgens is a smallish, rough-barked tree with a lustrous, green eanopy and buds and fruits similar to other members of group. On the basis of juvenile morphology, Chappill *et al.* (1986) suggested that populations of eastern Vietoria, ineluding *E. fulgens*, shared eommon features with the swamp gums, that is *E. ovata* and others. This position is strongly supported by the early development of distinetly petiolate, regularly alternate, somewhat ovate-shaped juvenile leaves whieh are features elosely resembling those of swamp gums sueh as *E. ovata*. However, this is not the opinion held here. Its ovoid buds, sub-globular fruits, spongy, sub-fibrous, strongly aromatie, often deeply furrowed, persisting bark and strongly aromatie juvenile leaves are eonsistent with *E. aromaphloia* and its relatives.

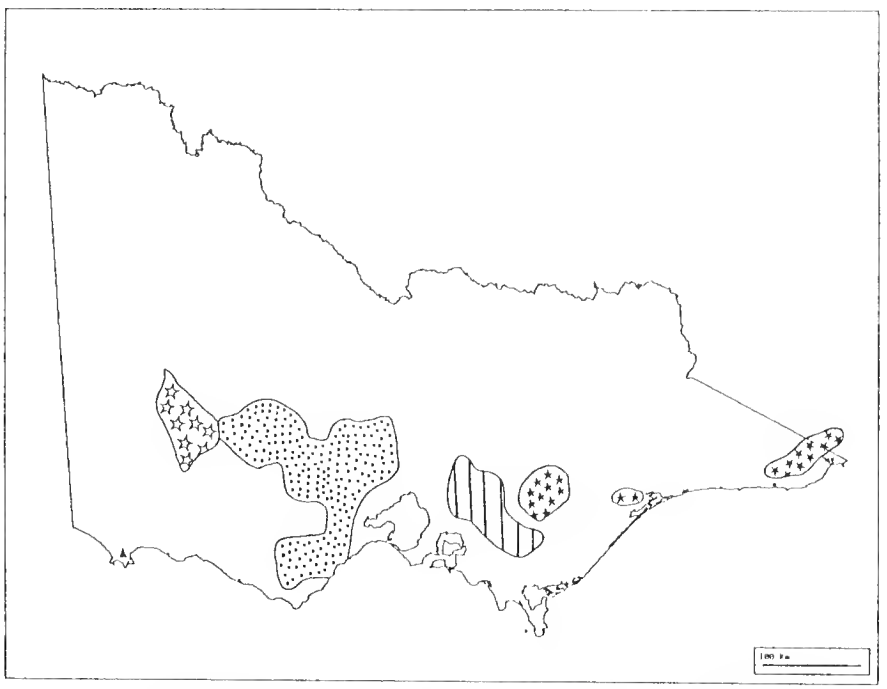

Fig. 1. Distribution of *Eucalyptus fulgens* ||| , *Eucalyptus sabulosa* ☆☆☆☆, *Eucalyptus splendens* ▲, *Eucalyptus aromaphloia* ::::, *Eucalyptus ignorabilis* ★★★★.

The species most closely related to *E. fulgens* is *E. ignorabilis*, the two being inseparable in bud and fruit morphology and occupying ranges adjacent to each other. Even more important is that they possess similar seedling ontogenies and share particular seedling features. Both exhibit relatively early development of alternate, petiolate juvenile leaves and both possess non-glaucous seedling growth tips. In contrast, however, the juveniles of *E. fulgens* are usually larger and are pale green or slightly blue-green rather than grey-green in *E. ignorabilis* (Table 1). Also as the seedlings reach intermediacy, the juvenile leaves of *E. fulgens* become sub-lustrous rather than remaining dull as in *E. ignorabilis*. Eventually, the canopy of *E. fulgens* becomes conspicuously lustrous and green which contrasts markedly with the dull, greyish one of *E. ignorabilis* and, as in the juvenile stage, the adult leaves of *E. fulgens* are usually longer (15-25 cm compared with 10-17 cm long). Lastly, the often deeply furrowed, ragged bark of *E. fulgens* is a marked contrast to the bark of typical *E. ignorabilis* which is thin with fine, longitudinal furrows and peppermint-like in appearance.

There are appreciable differences between *E. aromaphloia* and *E. fulgens* with the former featuring seedlings with waxy growth tips and juvenile leaves that are grey, smaller and generally elliptical to ovate-shaped with shorter petioles throughout juvenility. Furthermore, the rate at which the seedlings of *E. fulgens* develop differs from that of *E. aromaphloia*. Although the juveniles of both become disjunct at approximately the same number of nodes, those of the latter are irregularly opposite, sub-opposite or alternate for numerous pairs (as is the case with the other new species described here). Other subtle differences exist in adult morphology, e.g. although the canopy of *E. aromaphloia* is usually lustrous, it is appreciably blue and its fruits are most often sessile or sub-sessile.

SPECIMENS EXAMINED

VICTORIA: Yarra Junction, 24 Oct. 1954, *N.A. Wakefield* (MEL1608542); Quamby Road, Upper Beaconsfield, 28 June 1964, *J.H. Willis* (MEL1607349); Coranderk Reserve, Picaninny Swamp, Badger Creek via Healesville, 14 May 1973, *J.H. Willis* (MEL514983); Kinglake National Park, 28 July 1982, *A.C. Beauglehole 70837* (MEL1609456); Warburton Highway, adjacent to the Woori Yallock Plant Nursery, east of Woori Yallock, 20 Oct. 1989, *K. Rule* (MEL1593202); 14 km north of Yarra Glen on the Melba Highway, 2 Oct. 1990, *K. Rule 9025* (MEL); adjacent to the Lang Lang Golf Course, 7 km from the intersection of the South Gippsland and Bass Highways, 10 Nov. 1990, *K. Rule 9075* (MEL); 500 m from the Nar Nar Goon turnoff on the Prince's Highway, 1 May 1991, *K. Rule 9148* (MEL); 8.3 km north of Moe towards Erica, 24 Jan. 1992, *K. Rule 9218* (MEL); 600 m west of Gumbuya Park on the Prince's Highway, 7 Feb. 1992, *M.I.H. Brooker 10940* (MEL1616812).

2. *Eucalyptus sabulosa* K.Rule *sp. nov.*

Eucalypto aromaphloiae L.D.Pryor & J.H.Willis affinis, foliis juvenilibus nitido-viridibus sessilibus linearibus falcatis, foliis adultis hebetibus vel sub-nitentibus, pallido-viridibus vel caesio-viridibus differt.

HOLOTYPUS: 23 km south of Nhill, Victoria, 36°32'S, 141°40'E, 4 May 1981, *G.C. Cornwall 340* (MEL641778).

Small, spreading trees to 12 m tall. *Bark* sub-fibrous, somewhat scaly, irregularly furrowed, grey, persisting on trunk and branches. *Seedling leaves* linear, decussate, sessile, blue-green, crowded alongthe axis but not heath-like. *Juvenile leaves* linear, falcate, sessile for 20 nodes or more then sub-sessile for numerous pairs there after, opposite for a similar number of nodes then irregularly opposite, sub-opposite or alternate for numerous pairs thereafter, acuminate, glandular, lustrous and green for numerous pairs (with older leaves becoming sub-lustrous and blue-green), discolorous, 4-9 x 0.5-1.0 cm; venation inconspicuous; growth tips lustrous, green; nodes often crowded but not heath-like; petioles to 4 mm long. *Intermediate leaves* linear-lanceolate or narrowly lanceolate, falcate, sub-lustrous blue-green, alternate, shortly petiolate, larger than juvenile leaves. *Adult leaves* lanceolate, falcate, dull or sub-lustrous, light green or slightly blue-green, glandular, acuminate, to 16 x 2 cm; intramarginal vein not

remote, 1-2 mm from margin; minor venation moderately reticulate, inconspicuous with relatively sparse island oil glands; petioles flattened, to 1.7 cm long. *Inflorescences* simple, axillary, 7-flowered; peduncles slightly angled, to 1.0 cm. *Floral buds* ovoid, shortly pedicellate, scarred to 5 x 3 mm; opercula conical, approximately as long as hypanthia; filaments white; anthers all fertile, irregularly inflexed, versatile, oblong, dehiscing through longitudinal pores. *Fruits* ovoid or sub-globular, sub-sessile, 5-6 x 4-6 mm; valves 3 or 4, slightly exerted; disc ascending; locules 3-4; pedicels 1-3 mm long. *Fertile seeds* black, irregularly shaped, slightly flattened, lacunose.

FLOWERING PERIOD
Autumn.

DISTRIBUTION
Eucalyptus sabulosa occurs throughout the Grampian Ranges, except along the Mt William Range, and extends westwards into the centre of the Little Desert. Populations are small and sporadic and always on sandy soils (Fig. 1)

ASSOCIATED SPECIES
The new species and *E. aromaphloia* overlap on the eastern edge of the Grampians in the Hall's Gap-Pomonal area. In the Grampians and its surrounds, associated species include *E. alaticaulis* Watson & Ladiges, *E. baxteri* (Benth.) Maiden & Blakely, *E. melliodora* A.Cunn. ex Schauer, two forms of *E. goniocalyx* F.Muell. ex Miq. and *E. obliqua*. In other areas such as the Little Desert, *E. arenacea* Marginson & Ladiges is a common associate whilst *E. leucoxylon* F.Muell. subsp. *stephaniae* K.Rule and various mallee species may occur nearby.

ETYMOLOGY
The specific name is derived from Latin and means 'of the sand' which describes the new species habitat.

CONSERVATION STATUS
Even though *E. sabulosa* occurs in small, sporadic populations, it is a common species and not in danger.

DISCUSSION
The original description of *E. corticosa* emphasised distinctive narrow, blue-green juvenile leaves. Although this description, in part, can be applied to *E. sabulosa*, the two are separable on the basis of other seedling differences. Juvenile leaves of the new species, for example, are sessile for many more pairs and are linear and markedly falcate rather than narrow-lanceolate and non-falcate. There are also differences in adult characters, particularly in adult leaves and fruits, which have been discussed above.

Populations of *E. sabulosa* and *E. aromaphloia* overlap in the vicinity of Hall's Gap and Pomonal but are readily separable in the field on the basis of canopy lustre and juvenile leaf colour. Field studies and seedling trials have indicated hybridism between the two in this area. West of Hall's Gap, starting in the Serra Range, populations of *E. sabulosa* show no influence of *E. aromaphloia*.

Whereas the adult leaves of *E. sabulosa* are dull or sub-lustrous, light green or slightly blue-green and sparse in oil glands, those of *E. aromaphloia*, in contrast, are more lustrous, exhibit a strong bluish tinge and are appreciably glandular. *Eucalyptus sabulosa* also differs from *E. aromaphloia* whose seedlings have waxy new growth and juvenile leaves that dull and grey, always broader and non-falcate and are opposite and sessile for fewer pairs (Table 1). Lastly, the two species have different habitats. *Eucalyptus aromaphloia* is usually found in heavier, poorly drained soils, in contrast to the preferred sandy soils of *E. sabulosa*. However, populations of *E. aromaphloia* occur in the Black Range near Stawell occur on granite derived soils. In most respects these are consistent with other populations of that species.

Although their respective seedling morphologies and ontogenies differ, *E. sabulosa* and *E. aromaphloia* are considered to be closely related. Their adjacent geographical positions and similarities in the adult features of bark, fruits and buds, support this proposition.

SPECIMENS EXAMINED

VICTORIA: Little Desert, 3 miles [4.8 km] west of Dimboola, 20 Sep. 1948, *J.H. Willis* (MEL706601); Little Desert at Huff's Swamp, 11 Sep. 1949, *J.H. Willis*, (MEL1607347); Road between the Chimney Pots and Billywing, Victoria Range, along the western foot of the range, 23 Feb. 1957, *M. McGarvie, P.E. Finck and A.C. Beauglehole 4082* (MEL); Teddy Bear's Gap, Serra Range, Grampians, 19 Nov. 1961, *N.A. Wakefield*, (MEL1610753; 6 miles [9.6 km] south of Moora Reservoir between Serra and Victoria Ranges, Grampians, 19 Nov. 1961, *N.A. Wakefield* (MEL1610749); Mt Rosea Summit, 16 Mar. 1968, *A.C. Beauglehole 24952* (MEL); Lake Wartook, southern side, 30 June 1972, *A.C. Beauglehole 38386* (MEL); 20 km south-east of Nhill, northern end of Little Desert National Park, 4 May 1981, *G.C. Cornwall 365* (MEL); Victoria Range, beside Old Billywing Track, on western side of range, 6 Apr. 1985, *M.G. Corrick 9430*, (MEL); Adjacent to the Dunkeld Golf Course, 5 km NNW of Dunkeld, 6 Sep. 1988, *D. Frood 022/88* (MEL).

3. *Eucalyptus splendens* K.Rule *sp. nov.*

Eucalypto aromaphloiae L.D.Pryor & J.H.Willis affinis, foliis juvenilibus nitido-viridibus lanceolatis vel ovato-lanceolatis, caulibus plantularum cristatis subtiliter, valvis fructuum exsertis differt.

HOLOTYPUS: On the eastern perimeter of the Mt Richmond settlement, Portland-Nelson Rd. 38°12'S, 141°20'E, 29 Sep. 1992, *K. Rule 9272* (MEL).

Small, spreading trees to 10 m tall. *Bark* sub-fibrous, grey-brown, irregularly fissured, persistent throughout; light brown, smooth on branches, decorticating in short strips. Seedling leaves narrow-elliptical, decussate, sessile, pale green. *Juvenile leaves* narrow-lanceolate, lanceolate, becoming ovate-lanceolate in advanced juvenility, sessile then shortly petiolate approximately after 15 nodes, discolorous, lustrous green above and light green below, maturing to blue-green, glandular, acuminate, becoming disjunct (irregularly opposite, sub-opposite or alternate) between 10 and 18 nodes, 4-7 x 1-2 cm; growth tips lustrous; venation inconspicuous; stems square in section, finely ridged; nodes usually moderately crowded. Intermediate leaves ovate-lanceolate or ovate, shortly petiolate, lustrous, blue-green, concolorous. *Adult leaves* lanceolate, sub-lustrous or lustrous, slightly blue-green, glandular, 12-20 x 1.5-2.2 cm; oil glands separate from veins; venation moderately reticulate; intramarginal veins 1-2 mm from margin; petioles slightly flattened, 1.5-2 cm long. *Inflorescences* simple, axillary, 7-flowered. *Peduncles* angled, slightly terete, 6-10 mm long. *Floral buds* ovoid, scarred, shortly petiolate, 4-6 x 3-4 mm; opercula conical or obtuse-conical, as long as hypanthia; stamens all fertile, irregularly inflexed; filaments white; anthers versatile, oblong, dehiscing through longitudinal pores. *Fruits* ovoid or sub-globular, sub-sessile, 5-6 x 4-6 mm; discs ascending; valves often prominently exerted; locules 3 or 4; pedicels 1-2 mm long. *Fertile seeds* black, irregularly shaped, slightly flattened, lacunose.

DISTRIBUTION

Eucalyptus splendens is known only from a single locality to the north west of Portland in Western Victoria between Mt Richmond settlement and Mt Richmond (Fig. 1). It grows on heavy soils of volcanic origin. The distribution which covers a linear distance of approximately 8 km and which contains several large remnants occurs along a narrow sub-coastal, seasonally water-logged belt within a few kilometres of the ocean.

ASSOCIATED SPECIES

Eucalyptus splendens, often an abundant species, occurs in pure stands or in association with *Eucalyptus willisii* subsp. *willisii* Ladiges, Humphreys & Brooker, *Eucalyptus kitsoniana* Maiden and a large-fruited form of *Eucalyptus ovata, Eucalyptus baxteri*, *Eucalyptus obliqua* and *Eucalyptus viminalis* subsp. *cygnetensis* also occur in the vicinity but have no contact with this new species.

CONSERVATION STATUS

Eucalyptus splendens is a species of restricted distribution. It occurs within protected reserves, at the roadside along the Nelson-Portland Road and exists in remnants on adjacent farms where .substantial numbers have been lost. In accordance with criteria of Briggs and Leigh (1989) a code of 2E is suggested for this species.

ETYMOLOGY

The specific name is derived from Latin and alludes to the lustrous juvenile leaves.

DISCUSSION

Considerable credit for knowledge of *Eucalyptus splendens* must be given to Mr. Cliff Beauglehole of Portland who had been aware of the species existence for many decades. It was through his persistence that this treatment eventuated. In 1989 Mr. Beauglehole sent me specimens, including seedlots, and seedling trials confirmed his assertion that the Portland scent barks not only were true-breeding but represented an undescribed taxon.

Known to local observers as 'Apple Jack', *Eucalyptus splendens* appears to have been confused with *E. viminalis* subsp. *cygnetensis*, another seven-flowered, rough-barked tree present in south-west Victoria. Both taxa are similar in adult morphology but are readily separable in the seedling stage. Whereas *E. viminalis* and its subspecies have persisting decussate juveniles, those of *E. splendens* become irregularly spiralled along the axis and show considerably earlier disjunction. Further, the juveniles of the new species have tapered rather than amplexicaul bases and approach an ovate shape in advanced juvenility rather than remaining lanceolate. Further, as is evident in the field, the fruits of *E. splendens*, with their raised discs and exserted valves, are inconsistent with the manna gums.

Whilst the rate at which the juvenile leaves of *E. splendens* become disjunct and petiolate corresponds with that of *E. aromaphloia*, it possesses a suite of seedling features inconsistent with that species. For example, the lanceolate, lustrous and light green juveniles, the non-waxy growth tips and the squared, ridged stems are distinctive. Further, the fruits of *E. splendens*, as described above, are not consistent with *E. aromaphloia*.

The affinities of *E. splendens* are unclear but it has been tentatively included with *E. aromaphloia* and its relatives. Although the morphology of its seedling stems and its fruit structure are unique within the group, on the basis of particular shared seedling and adult features, those taxa are regarded as being somewhat distant relatives. With regard to the manna gums, the fundamental differences in seedling development and morphology suggest an even more distant relationship.

SPECIMENS EXAMINED

VICTORIA: west of Mt Kineade, 29 km north-west of Portland, *A.C. Beauglehole* (MEL); 28.9 km from Portland towards Nelson by road, 29 Sep. 1992, *K. Rule 9273* (MEL); 22.2 km from Portland towards Nelson by road, 29 Sep. 1992, *K. Rule 9273* (MEL); 0.9 km west of Heath Road near Mt Kineade, 30 Sep. 1993, *K. Rule 9378* (MEL); The intersection of Heath Road and the Portland-Nelson Road, 2.4 km east of Mt Richmond township, Sep. 1993, *K. Rule 9379* (MEL); The intersection of Stephens Road and the Portland-Nelson, north-west of Portland, 30 Sep. 1993, *K. Rule 9382* (MEL).

KEY TO *EUCALYPTUS AROMAPHLOIA* AND ITS RELATIVES

1. New growth of seedlings waxy ..... ***Eucalyptus aromaphloia***
1. New growth of seedlings non-waxy.....2

2. Juvenile leaves lanceolate or ovate-lanceolate with upper surface lustrous and light green; seedling stems square in section and finely ridged ..... ***Eucalyptus splendens***
2. Juvenile leaves without the above combination of shape, lustre and colour; seedling stems round in section, rarely square, never finely ridged.....3

3. Juvenile leaves sessile for numerous pairs, linear and markedly falcate; fruits sessile or sub-sessile ..... ***Eucalyptus sabulosa***

3. Juvenile leaves petiolate, narrow-lanceolate or broader and non-falcate; fruits distinctly pedicellate

4. Canopy lustrous and green ..... ***Eucalyptus fulgeus***
4. Canopy dull, grey-green.....4

5. Juvenile leaves lanceolate or ovate-lanceolate, grey-green; fibrous bark finely furrowed and thin ..... ***Eucalyptus iguorabilis***
5. Juvenile leaves narrow-lanceolate, blue-green; fibrous 5
bark deeply furrowed, thick and spongy ..... ***Eucalyptus corticosa***

Notes on morphological variation within populations of *Eucalyptus arouaphloia*

Studies of populations of *E. aromaphloia* showed it to be a markedly polymorphic species. Several morphological forms have been identified, each of which exhibits a subtle or not so subtle distinctiveness in a range of characters.

The type locality of *Eucalyptus aromaphloia* is at the 113 mile post on the Western Highway near Buangor between Beaufort and Ararat. Here the trees are characterised by their somewhat lustrous, blue-green canopies, by their seedlings with waxy growth tips and juvenile leaves that are elliptical, grey-green, shortly petiolate and irregularly opposite, sub-opposite or alternate and by their subsessile, relatively large fruits (5-7 mm wide). This form is the most common and, although being variable in the colour and lustre of its canopy, in the width of its juvenile leaves and in its fruit morphology, accounts for the bulk of the populations of scentbark in west-central Victoria, including those along the Otway coast from Anglesea to near Port Campbell. In addition, there are a number of regional and morphological forms:

A forest form occurs along the Great Dividing Range in the vicinity of Creswick. It has broader juvenile leaves than typical (approaching sub-orbicular) and relatively large, slightly undulate adult leaves.

To the west of the type locality, in the vicinity of Moyston , is a form with a lustrous, appreciably green canopy and tightly clustered sessile fruits. In the field it resembles a manna gum.

Populations with green adult leaves and tightly sessile fruits fruit also occur in low woodland communities in the vicinity of Anglesea. These populations also possess relatively broad juvenile leaves.

In the Black Range near Stawell and near Hall's Gap and Pomonal a form with narrow, conspicuously waxy juvenile leaves occurs on granite soils. Other populations with relatively narrow juvenile leaves occur on undulating terrain to the north-west of Mt Buangor. These have smaller fruits and narrower adult leaves than typical populations.

Populations with juvenile leaves of variable width occur along the Grampian's Mt William Range at an altitude of between 800 and 1000 m. They differ from typical populations in exhibiting lustrous, relatively coriaceous juvenile leaves rather than the dull, soft-textured ones of other forms. Further, these populations are often shrubby in habit, carry reduced amounts of rough bark and possess adult leaves that are markedly coriaceous, lustrous and relatively narrow. Fruits of this form are larger than most lowland forms.

Outlier populations occur on relatively dry slopes and ridges of the Pyrenees and St Arnaud ranges. These are small-fruited with small, blue-green or grey-green adult leaves and their juvenile leaves are within the typical range. In the Pyrenees Range, particularly on Mt Avoca, fruits have flattened discs and the St Arnaud Range trees exhibit a bark that is neat, shallowly furrowed and slightly tessellated in appearance.

Lastly, the most divergent form located so far occurs as a single, somewhat disjunct population on dry sedimentary slopes of the Fryers Range near Castlemaine in North-central Victoria. Its distinctive features include smaller adult leaves and fruits than typical and linear-oblong, markedly falcate juvenile leaves.

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A revision of the *Cardamine gunnii-lilacina* complex (Brassicaceae)

Ian R. Thompson & Pauline Y. Ladiges

School of Botany, The University of Melbourne, Parkville, 3052, Victoria, Australia.

ABSTRACT

Phenetic analysis of morphological variation in alpine and sub-alpine populations of *Cardamine* transplanted from the field and grown from seed resulted in the identification of two new species, *Cardamine franklinensis* I. Thomps. formerly included in *Cardamine gunnii* and *Cardamine robusta* I. Thomps., formerly included in *Cardamine lilacina*. Examination of herbarium material, field observations and growth trials resulted in the identification of a further new species, *Cardamine astoniae* I. Thomps., formerly included in *Cardamine lilacina*.

Introduction

Cardamine L. is a genus of about 200 species in the family Brassicaceae. The majority of species occur in temperate regions of northern and southern hemispheres. In Australia, a small number of endemic species are currently recognised, the majority of which are confined to south-eastern Australia, including Tasmania. They occur in moist habitats which include lowland swamps or watercourses, forests, sub-alpine woodlands and a variety of alpine habitats. Several introduced species have become naturalised in Australia and, although predominantly urban weeds, can occupy similar habitats to the native species.

Several Australian species in the genus *Rorippa* resemble Australian *Cardamine* and, until fairly recently, were placed in the latter genus. These taxa are still occasionally misidentified as *Cardamine*. They can be distinguished by several features including the shape of the replum (septum) margin of the siliqua which is flanged in *Cardamine* but not in *Rorippa*, seed morphology and the mechanism of dehiscence (in *Cardamine* this is explosive and results in the valves becoming coiled as they rapidly separate from the replum).

An account of Australian *Cardamine* in 1982 by Hewson (1982), although perhaps describing more of its diversity than previous flora treatments, failed to fully resolve its taxonomy. Her treatment of the *Cardamine gunnii-lilacina* complex (terrestrial, glabrous perennials with petals greater than 4 mm long) has created some uncertainty. Forms within this complex grow predominantly in higher altitude areas of south-eastern Australia and Tasmania. Hewson's key separates the two species as follows:

style up to 1 mm long - *C. gunnii*;
style 1-3 mm long - *C. lilacina*.

Style length refers to its length in the mature siliqua. Descriptions of the two species point to petal length as another means of distinguishing these species although the ranges for this character overlap. Petal length and style length, although useful characters, are unsatisfactory on their own for distinguishing forms within this complex. These characters vary within populations depending on season and stage of flowering and some populations have been found to have plants with style lengths ranging from less than 1 mm to more than 1 mm.

Hewson identified two informal variants of *C. gunnii*, one with pinnate and pinnatisect leaves with a large terminal ovate or reniform lobe, and the other with leaves entire-spathulate or pinnatisect with an elliptic to ovate terminal lobe. She identified four informal variants of *C. lilacina*, which vary in the dimensions of flower, fruit and seed and in the shape and number of leaf pinnae. She noted that variation was almost continuous and that further study was necessary to resolve this complex of variants. The

following study encompasses some of this variation and is based on live plant material collected from the field.

Materials and methods

Plants and seeds were collected in February and March, 1994 from six major regions (Fig. 1). Four in north-eastern Victoria (Mts Buffalo, Bogong, Nelse and near Mt. Hotham), one in south-eastern New South Wales (Kosciusko National Park) and one on the western border of the Australain Capital Territory (Brindabella Ranges). In most localities, especially in Victoria, populations were small and ripe fruits were present on only a few plants as the main flowering period is in November and December. Consequently, the number of plants removed for transplanting to pots was low in most cases and seed was collected from a small range of plants. Plants to be transplanted were maintained in plastic bags prior to potting up.

Two trials of alpine and sub-alpine plants were set up using the material collected from the field. A transplant trial containing 40 plants from 12 populations was established in February and March, 1994 by potting up the field-collected plants using a standard potting mix. The transplants were maintained outdoors over seven months and were subjected to Melbourne's climate. A seedling trial of 153 plants from 12 populations was established in April and May by germinating field-collected seeds in punnets in a heated glasshouse. For each population, seeds were derived from a variable number of parent plants ranging from one to four. In most cases, seeds germinated readily 7-21 days after sowing and germination rates approached 100%. Seedlings were transferred to 10 cm pots at the two-leaf stage and grown on in a heated glasshouse with pots arranged in a random-block design. Seedlings were also grown outside for comparison with the glasshouse-grown seedlings.

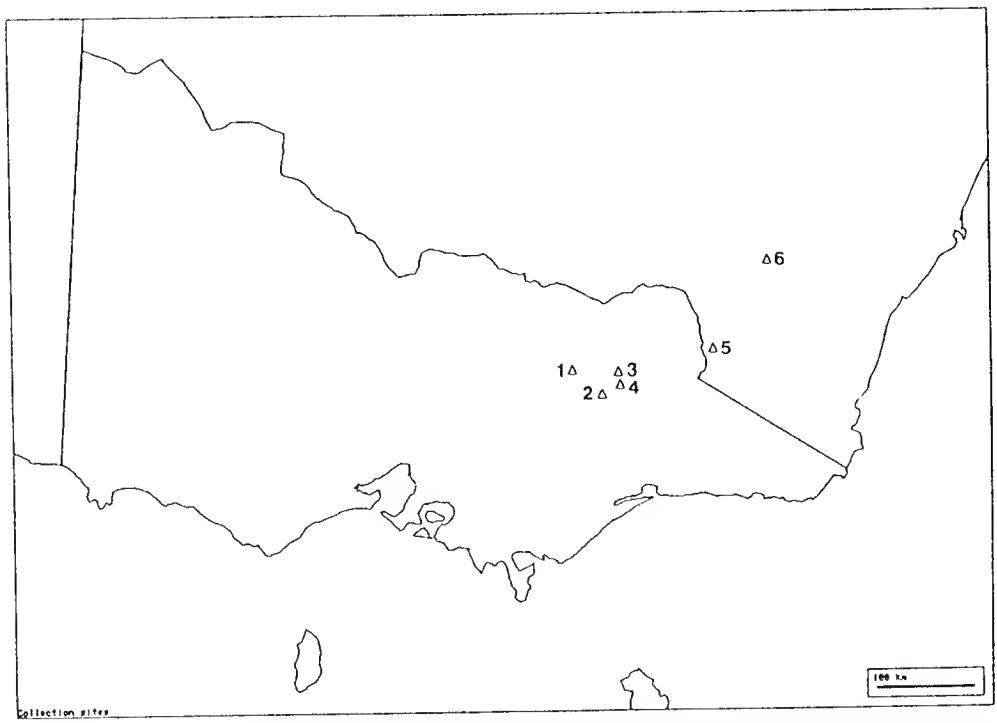

Fig. 1. Collection sites for alpine and sub-alpine *Cardamine* populations. 1. Mt Buffalo; 2. Mt Higginbotham; 3. Mt Bogong; 4. Mt Nelse; 5. Kosciusko Region (Blue Lake and Charlotte Pass); 6. Brindabella Ranges (Mt Franklin and Mt Gingera).

Herbarium material, from a greater range of eolleeting sites in south-eastern Australia, from SYD, CANB, CBG, MEL and MELU was also examined.

PHENETIC ANALYSIS

Nineteen vegetative and reproduetive eharaeters were used for the phenetie analysis of the transplants and twelve vegetative eharaeters were used for the analysis of the seedlings (Table 1).

Morphologieal data from the seedling and transplant trials were phenetieally analysed using the PATN paekage (Belbin, 1987). All data were range standardised. The Manhattan Metrie (Williams, 1976) assoeiation measure was used to ealeulate a dissimilarity matrix.

Two agglomerative methods were used to produee an hierarehieal elassifieation: the Unweighted Pair-Group Method of Averages (UPGMA) and the Weighted Pair-Group Method of Averages (WPGMA). Dendrograms were produeed using the DEND program and Cramer values were used to determine whieh eharaeters best diseriminated the final groups identified.

The dissimilarity matrix was also used in an ordination analysis. The KYSP program used Hybrid Multi-Dimensional Sealing (HMDS; Faith *et al.*, 1987) to produee a three dimensional ordination. The ordination with the lowest stress was seleeted from twenty iterations.

Results

The agglomerative elassifieation of 40 transplants identified three main groups (Fig. 2), two eonsisting of individuals from single eolleetion sites and the third eonsisting of individuals from a number of sites.

The three Blue Lake individuals (BL) were the most distinet, forming a eluster (group 1) that fused last in the elassifieation (node a, Fig. 2). Two unique attributes distinguished the Blue Lake individuals. Firstly, vegetative stems of these plants elongate vertieally as new leaves form, resulting in the rosette of leaves being held well above soil level, and seeondly, infloreseenee braneh es do not form from the axils of the eauline leaves as they do in the other transplants. Furthermore, Blue Lake plants have longer, and partieularly broader petals than plants from other loealities. Within the Blue Lake population, some variation oeeurred in petal shape, style length at anthesis and infloreseenee arehiteeture.

TABLE 1. LIST OF CHARACTERS FOR PHENETIC ANALYSIS OF TRANSPLANTS AND SEEDLINGS.

Transplant trial characters:	**Seedling trial characters:**
1. Petal length	1. Cotyledon lamina length
2. Petal width	2. Cotyledon lamina width
3. Style length at anthesis	3. Cotyledon lamina length to width ratio
4. Filament width	4. Cotyledon petiole length
5. Filament length to width ratio	5. Leaf number of first pinnate leaf
6. Sepal length	6. Leaf petiole width
7. Pedieel length at anthesis	7. Leaf length
8. Siliqua length	8. Maximum number of leaflets/leaf
9. Siliqua width	9. Cotyledon lamina margins reeurved or not
10. Seed length	10. Cotyledon lamina surfaee plane or eoneave
11. Rosette leaves -maximum length	11. Terminal leaflet base euneate or truneate-eordate
12. Rosette leaves - maximum no. of leaflets	12. Vegetative stem elongating or not

TABLE 1. CONTINUED.

Transplant trial characters:	Seedling trial characters:
13. Cauline leaves -no. per scape	
14. Rosette leaves terminal pinna cuneate or truncate-cordate	
15. Lateral pinnae sessile or not	
16. Projections from leaf rachis, present or absent	
17. Cauline 2° inflorescences, present or absent	
18. Flowers opening below, level with or above cluster of buds	
19. Vegetative stem elongating or not	

Plants collected from Mt. Franklin (FN, FS) clustered into two quite separate groups. Seven individuals formed group 2 (node b, Fig. 2, all from FN) and are distinct from all other transplants on the basis of leaf morphology. The terminal pinnae of basal leaves (laminae in the case of simple leaves) are elliptic and strongly cuneate at the base, and lateral pinnae, if present, are sessile (Fig. 5). All other individuals have basal leaves with terminal pinnae that are ovate to orbicular with a slightly cuneate to strongly cordate base and lateral pinnae that are petiolulate.

The remaining major group, group 3, clustered at node e of the dendrogram (Fig. 2). These transplants all form a rosette at soil level (as do group 2 plants), have leaves unlike those of group 2, and produce secondary inflorescences from the axils of their cauline leaves. Within this group further clustering was evident which corresponded closely with geographical distribution.

Five individuals from Mt Higginbotham, Victoria (HI) were distinguished by having erect pedicels and flowers that clearly overtop the buds in the same raceme. They also have broader siliquas than other plants in group 3. In four of these individuals, small, leafy triangular projections were present along the margins of the leaf rachis. This feature was not observed in other individuals. Eleven individuals from Mt Franklin (FS, FN) and three from Mt Gingera (GA) were similar; Mt Franklin plants differ, however, from those from Mt Gingera in having shorter basal leaves, fewer cauline leaves, narrower siliquas, smaller seeds, spreading pedicels and flowers opening well below the level of the buds in the same raceme. Mt Gingera individuals have flowers mostly opening at the same level as the buds.

Individuals from several Victorian populations, Mts Nelse (NE), Bogong (BO), Loch (LO) and Buffalo (BU), were similar to three Charlotte Pass (CP, NSW) individuals being short styled (mean 0.9 mm, style length measured at anthesis) and having small petals (mean~6.4 mm). This contrasts with the larger flowered plants from Mts Higginbotham, Franklin and Gingera. Charlotte Pass individuals have more slender staminal filaments and longer pedicels than the small-flowered Victorian populations.

A three-dimensional ordination of the 40 individuals is displayed in Figures 3 and 4. Clusters corresponding to the three groups identified in the classification are well separated and reasonably discrete. Clusters recognised within group 3 in the classification mostly do not overlap in the ordination but are less well separated than the major groups.

Only vegetative characters were available for analysis in the seedling trial. The results of a phenetic analysis of the seedlings generally supported the groups identified by the transplant trial. Vegetative stem elongation and shape of terminal pinna, two characters that helped characterise groups 1 and 2 in the transplant trial, also distinguished these groups in this trial. Petiole width distinguished Higginbotham and Franklin (larger-flowered populations in group 3 of the transplant trial) from Nelse,

Bogong, Buffalo and Charlotte Pass (smaller-flowered populations in group 3 of the transplant trial).

Discussion

Classification and ordination analyses of transplants, and classification analysis of seedlings, demonstrated a pattern of morphological variation of discrete forms such that the recognition of taxa is warranted. Examination of herbarium material of these forms further supports the results of the phenetic analyses.

The Blue Lake population (*Cardamine robusta* sp. nov.) is representative of one taxon (Fig. 2, group 1). Plants from this locality have distinct above-ground stem morphology, large flowers and do not form secondary inflorescences from cauline leaf axils. There are, however, differences within the population in floral and inflorescence morphology. Subsequent examination of underground parts of transplants showed this taxon to also have unique robust underground stems which ascend to produce new rosettes a variable distance from the parent rosette. This taxon has been informally recognised in the *Flora of Australia* as the robust, snow-patch variant of *C. lilacina* and as **species A2** in the *Flora of NSW* (Harden, 1991). The description of this variant in these floras does not, however, identify the above features.

Mt Franklin plants are recognisable as a second taxon (*Cardamine franklinensis* sp. nov.) on the basis of unique leaf morphology, that is, the combination of elliptic terminal pinnae and sessile lateral pinnae (Fig 2, group 2). This taxon has been informally recognised (Hewson, 1982) as the spathulate-leaved variant of *C. gunnii*. Non-spathulate-leaved populations conforming strictly to *C. gunnii*, as circumscribed by Hewson, were not collected. As noted in the introduction, the distinction between these forms and *C. lilacina* based on examination of herbarium material and Hewson's descriptions is not clear (see also notes under *C. franklinensis* below).

The remaining group constitutes a third taxon and is referrable to *C. lilacina* Hook. There is some evidence of discrete morphological variation within this group but low population sizes in the transplant trial and a limited seed diversity in the seedling trial disallows formal recognition of these discrete forms at this stage. For this complex to be fully assessed, comparisons need to be made with a greater range of populations of *C.*

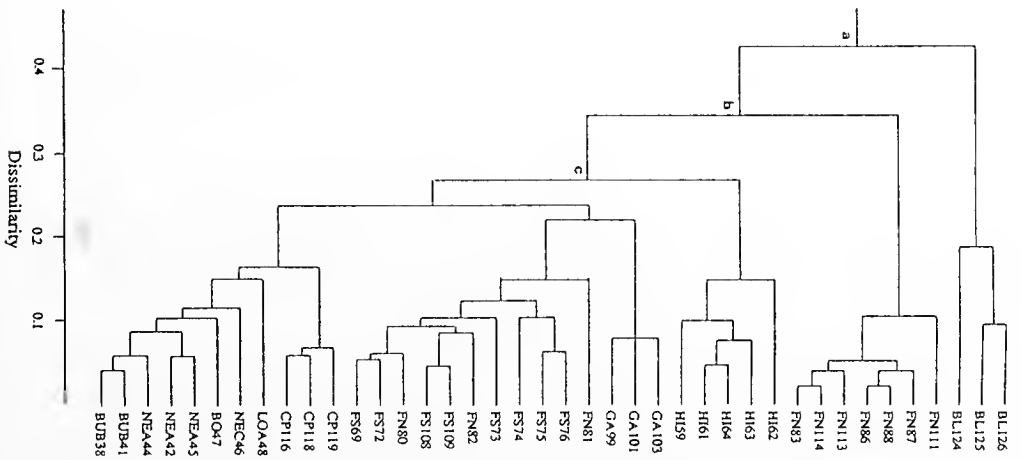

Fig. 2. Dendrogram showing results of cluster analysis of 40 alpine and sub-alpine transplants. Entire dendrogram shown (UPGMA fusion strategy). Group 1 locality - Blue Lake (BL); Group 2 locality - Mt. Franklin (FN); Group 3 localities - Mt. Buffalo (BU), Mt. Nelse(NE), Mt. Bogong(BO), Mt. Loch (LO), Mt Higginbotham (HI), Mt. Franklin (FS, FN), Mt. Gingera (GA), Charlotte Pass (CP).

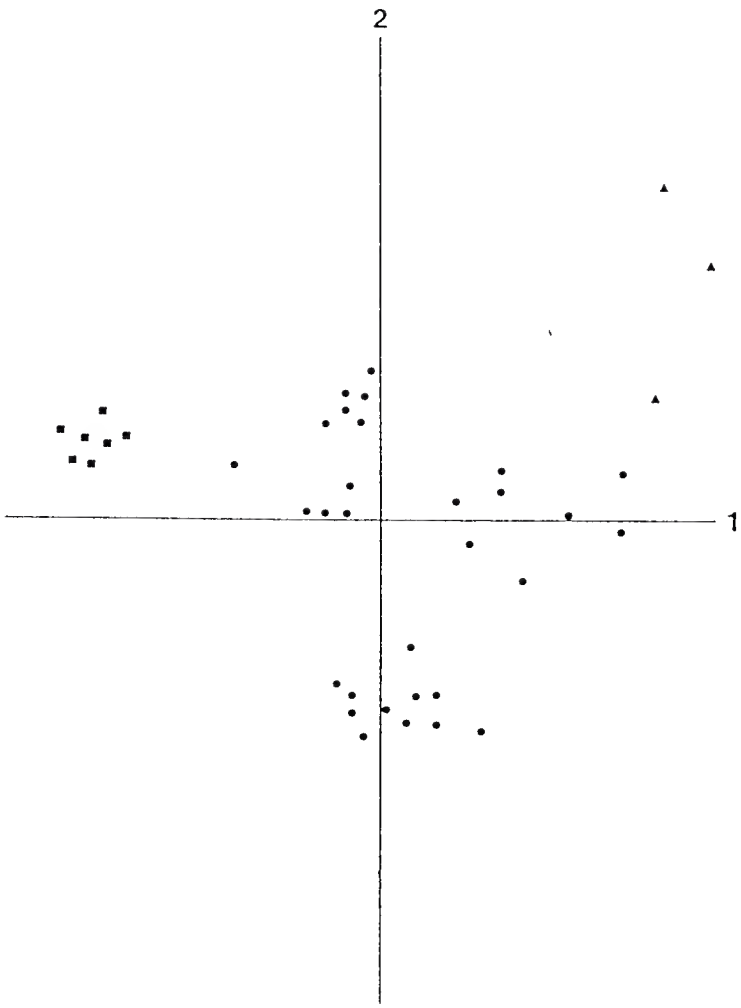

Fig. 3. Ordination of 40 transplants (Hybrid multi-dimensional scaling). Axes 1 and 2.▲ - Group 1 (Blue Lake) individuals; ▪ - Group 2 (Mt Franklin) individuals; • - Group 3 individuals.

lilacina and *C. gunnii*, in particular those occurring in lower altitude forests.

Chromosome counts from root tip squashes stained with lactoaceto-orcein indicated that the diploid number for each of these taxa was 48, although precise counts were not achieved. This number corresponds to counts by Thurling (1968) for higher altitude *Cardamine* in the Brindabella Ranges and Kosciusko area.

Subsequent to the phenetic analyses described above, field examination and growth trials of three alpine or sub-alpine *Cardamine* populations in Victoria and NSW, confirmed the existence of a new species, *C. astoniae* sp. nov. The existence of this species had been indicated by examination of herbarium records. This species is separable from *C. lilacina*, in which it was previously included, on the basis of stem and leaf characters. In the vegetative stage of growth above-ground stems grow horizontally and leaves do not form into a basal rosette. Leaves are usually simple or with only one pair of lateral pinnae. At flowering time the stem turns upwards to form a vertical scape.

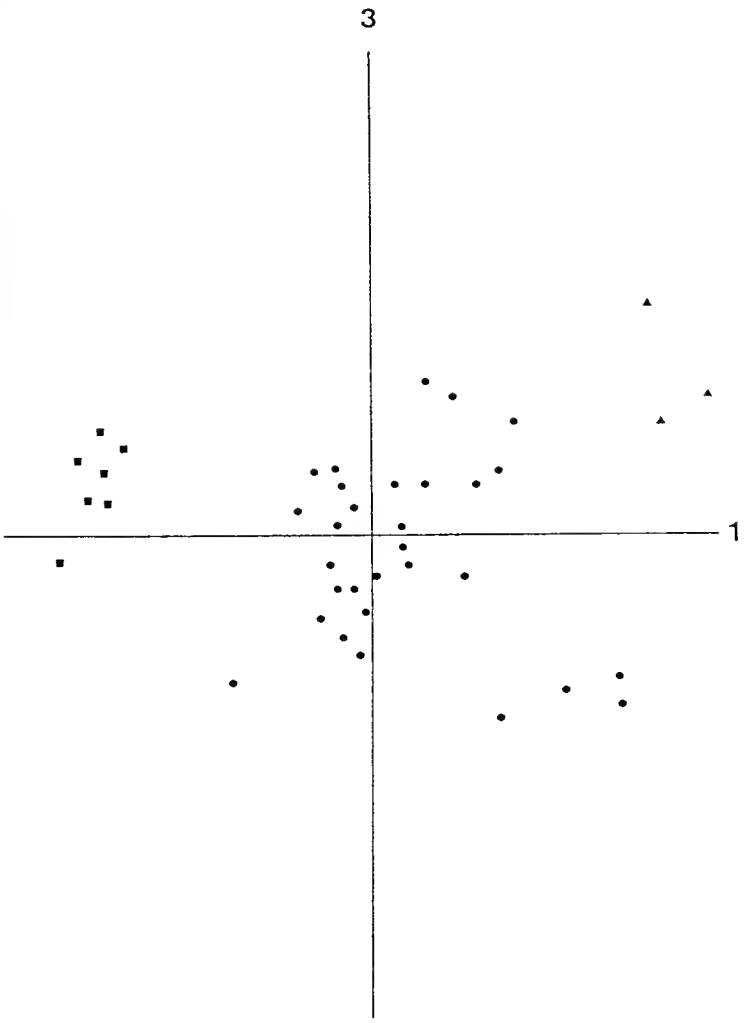

Fig. 4. Ordination of 40 transplants (Hybrid multi-dimensional scaling). Axes 1 and 2.▲ - Group 1 (Blue Lake) individuals; ▪ - Group 2 (Mt Franklin) individuals; • - Group 3 individuals.

Taxonomy

Cardamine robusta I.Thomps. *sp. nov.*

Cardamini lilacinae Hook. affinis, caulibus robustioribus, sobolibus robustis producentibus, caespitibus latis facientibus, foliis rosulae basibus aggregatis minoribus secus caulem, caule florenti simplici plerumque differt.

TYPUS: New South Wales, Club Lake, Kosciusko area 36°25'S, 148°16'E, 10 Jan. 1960, *B.G. Briggs* (HOLOTYPUS: NSW).

Perennial herb forming dense swards to c. 1m diameter, up to 30 cm tall, glabrous. *Roots* fibrous. *Vegetative stems* robust (3-10mm diameter), frequently branching above and below ground level, underground stems, white, growing more or less horizontally and then ascending to above ground level, above-ground stems of pressed specimens often wrinkled; flowering stem relatively slender and usually unbranched. *Leaves*

somewhat fleshy; basal leaves forming a rosette of erectly held leaves, the rosette usually distinctly above ground level and leaf bases somewhat loosely arranged along the stem, long petiolate, to 25 cm long, pinnate with 1-2(-3) pairs of lateral pinnae and a larger terminal pinna; terminal pinna broad-ovate to oblate the base cuneate to shallowly cordate, lateral pinnae similar in shape, long-petiolulate; cauline leaves 0-4, similar to basal leaves or much shorter and with pinnae becoming much narrower and more cuneate up the stem. *Inflorescences* few to many-flowered racemes, often condensed, sometimes more elongate. *Sepals* green, ovate, 3-4.5 mm long, petals broad, divided into limb and claw, 8-12 mm long, 5-7 mm wide, white; stamens 6; style at maturity 1-3 mm long. *Siliquas* 20-40 mm long, 2-3 mm wide on stout pedicels to 20 mm long. *Seeds* oblong-elliptic, 2-2.5 mm long. (Fig. 5)

DISTRIBUTION AND CONSERVATION STATUS

Cardamine robusta is endemic to alpine regions of the Kosciusko National Park in the Southern Tablelands of NSW and is recorded from several localities mostly associated with glacial lakes in this area, e.g. Blue Lake, Club Lake and Lake Albina. It does not appear to be threatened. (Fig. 6)

HABITAT

Cardamine robusta grows in alpine herbland/grasslands amongst granite boulders on moist slopes bordering glacial lakes, often bordering melting snow-patches.

ETYMOLOGY

The specific epithet of the new species refers to the vegetative stems which are more robust than in other native *Cardamine* species.

NOTES

Cardamine robusta has broad fruits and large seeds, similar to *C. astoniae* and higher altitude forms of *C. lilacina*. The development, in *C. robusta*, of thick underground stems to facilitate vegetative spread does not occur in these species although some vegetative spread can occur. In contrast to *C. lilacina*, secondary flowering stems are not normally produced from the axils of cauline leaves and typically racemes do not extend as far above the apices of the leaves (flowering often commences at or below the summit of the leaf mass). Petals are always white and large in *C. robusta*. Above ground vegetative stems are somewhat brittle when fresh and often are noticeably wrinkled following pressing. Basal leaves form a rosette with leaf bases relatively loosely arranged along a gradually elongating vegetative stem resulting in most basal leaves arising well clear of ground level. Leaves are often long and tend to be held fairly erectly. The propensity of *C. robusta* for vegetative spread means that broad and dense clumps up to c. 1 metre (or more?) in diameter can form. It flowers between January and April.

REPRESENTATIVE SPECIMENS (25 specimens examined)

NEW SOUTH WALES: Club Lake (Mt Kosciusko), 6200 ft, 20 Jan. 1951, *L.A.S. Johnson* (NSW); Lake Cootapatamba (Mt Kosciusko), 7 Jan. 1956, *M.E. Phillips* (NSW); Blue Lake, west bank (Mt Kosciusko) 21 Mar. 1971, *C. Totterdell* (NSW); 150 m downstream along Lady Northcote's Creek from Lake Albina, Kosciusko National Park, 6 Feb. 1993, *F.A. Zich 219* (NSW, MEL); Blue Lake, Southern Tablelands, 31 Jan. 1972, *I.R. Telford 3058* (CBG).

Cardamine franklinensis I.Thomps. *sp. nov.*

Cardamini lilacinae Hook. affinis, foliis simplicibus et spathulatis late, vel dissectis pinna terminali elliptica, pinnatis lateralibus in 1-2 paribus sessilis obovatis, seminibus parvioribus differt.

HOLOTYPUS: Australian Capital Territory, 2 miles [3.2 km] above Bendora on Mt Franklin Road, 13 Nov. 1953, *C.W.E. Moore 2777* (NSW).

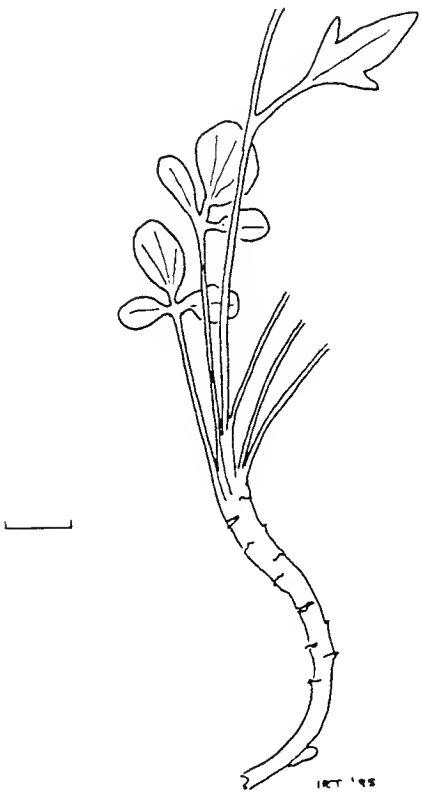

Fig 5. *Cardamine robusta*. Stem and leaves. From Briggs (NSW).

Perennial herb, to 30 cm tall, glabrous. *Tap-rooted. Stems* erect, usually branched from base and from cauline leaf axils. *Leaves* thin; basal leaves petiolate, to 15 cm long, simple or pinnate, mostly less than 7 cm long, forming an often dense persistent rosette; simple leaves entire to crenate, somewhat spathulate; pinnate leaves with an elliptic to ovate terminal pinna and 1-2 pairs of sessile, obovate, attenuate-based lateral pinnae; cauline leaves 0-3, reducing in size up the stem, lower ones sometimes similar to pinnate basal leaves, otherwise leaves simple, pinnatifid to entire. *Inflorescences* commonly many-flowered racemes. *Sepals* green or purple pigmented, ovate, 2-3 mm long; petals clearly divided into limb and claw, 4.5-6.5 mm long, all white or pink on the outside; stamens 6; mature style 1-2 mm long. *Siliquas* sub-erect, 25-35 mm long, 1.5-1.8 mm wide, pedicels erecto-patent c. 10 mm long. *Seeds* elliptic, 1.3-1.5 mm long. (Fig. 7)

DISTRIBUTION AND CONSERVATION STATUS

Cardamine franklinensis has been recorded from the Brindabella Ranges on the western boundary between Australian Capital Territory and New South Wales mostly in the vicinity of Mt Franklin, from Smiggin Holes in Mt Kosciusko National Park, from the eastern highlands of Victoria and from the central highlands in Tasmania. This species is not common and the only region from which there are multiple collections is the Brindabella ranges. The inconspicuous nature of the plant means that it is likely to be

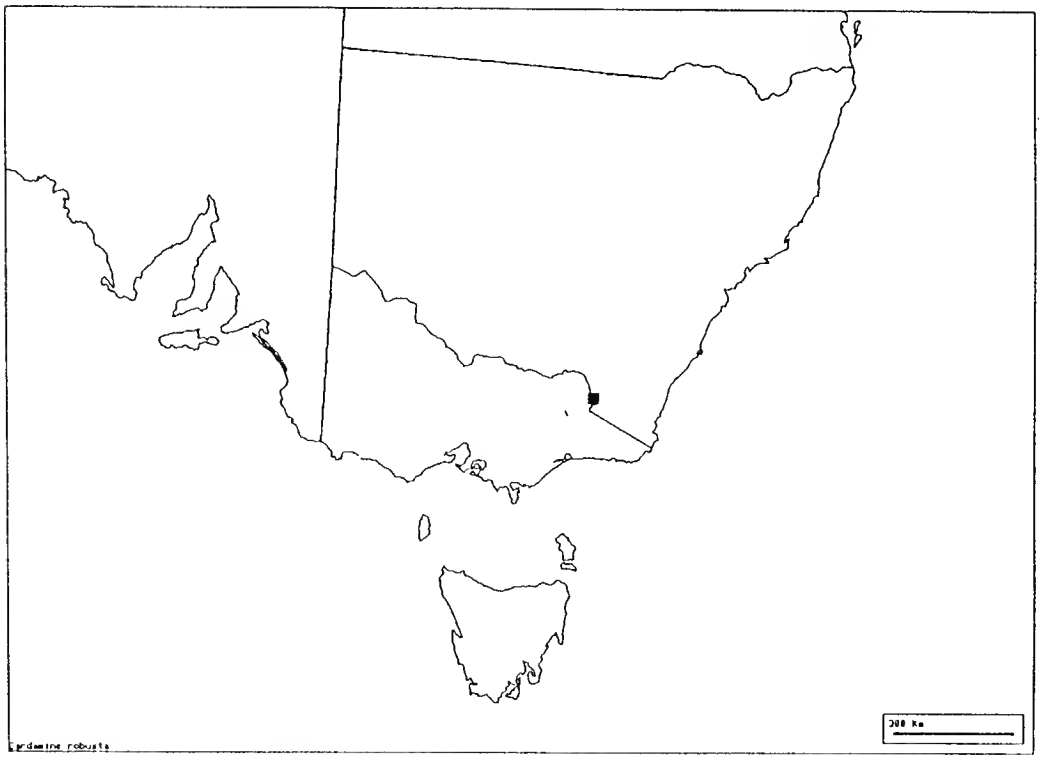

Fig. 6. Distribution of *Cardamine robusta*.

overlooked and may partly explain the small number of collections of this species. It is represented in Namadgi, Kosciusko and Alpine National Parks. (Fig. 8)

HABITAT

Cardamine franklinensis forms small colonies in sub-alpine woodland on rocky scree slopes or amongst *Poa* tussocks.

ETYMOLOGY

The specific epithet of the new species is named after the mountain (Mt Franklin) in the Brindabella ranges around which most collections of this species have been made.

NOTES

Cardamine franklinensis was formerly included in *C. gunnii* based on its petal size (between 4 and 6 mm long) and mature style length (less than 1 mm). In growth trials, however, the mature style of this species consistently exceeded 1 mm in length.

The lectotype of *C. gunnii* and several matching specimens on the same sheet have a distinctive root system with several sub-tuberous tapering roots arising from the base) and white petals 6-7 mm long. These are slightly longer than the often pink petals of *C. franklinensis*. *Cardamine gunnii sensu stricto* also has fewer basal leaves, different leaf morphology, (the terminal pinna of basal leaves mostly being triangular-ovate), is sometimes papillate and produces fewer-flowered racemes. It is thus appropriate to separate these two entities. Only one specimen of *C. gunnii s. str.* has been collected in the past 90 years, this a 1968 collection from Marsh's swamp near Mt Burr in south-east South Australia, although there are several nineteenth century collections from South Australia, Victoria and Tasmania. There is some doubt therefore as to whether *C. gunnii s. str.* is still in existence in Victoria and Tasmania. Locality information indicates that it occurs (or occurred) on lowland swamp margins and this further distinguishes it from *C. franklinensis*

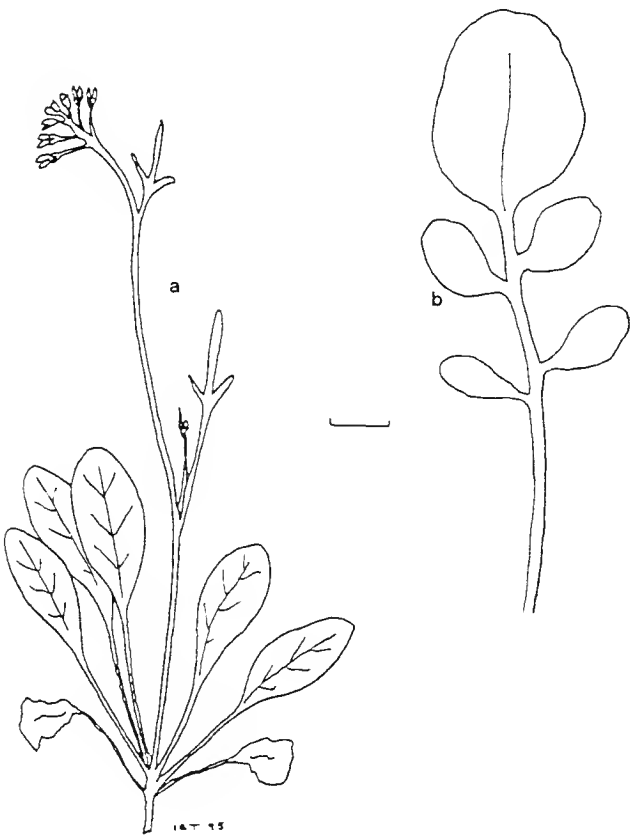

Fig. 7. *Cardamine franklinensis*. a - habit. b - basal leaf variant. a from *Burbidge 6692* (CBG), b from cultivated specimen.

Leaf morphology readily distinguishes *C. franklinensis* from the *C. lilacina* complex which is otherwise similar. Seeds of *C. franklinensis* are slightly smaller than the range for *C. lilacina* (1.5-3 mm long). Thurling (1968) seems to have included this entity in his breeding study of *Cardamine*. A population collected for this study (denoted as Race D) was described as entire-leaved (as *C. franklinensis* usually is) and it proved to be reproductively isolated from the other populations of *Cardamine* used in the trial, some of which are likely to have been *C. lilacina* based on collection site information.

REPRESENTATIVE SPECIMENS SEEN (12 specimens examined)

NEW SOUTH WALES: 2 miles [3.2 km] from Bendora on Mt. Franklin Road, 13 Nov. 1953, *C.W.E. Moore 2777* (NSW).

AUSTRALIAN CAPITAL TERRITORY: Eighty Acres, 6 km from Cotter River crossing at Cotter Flats towards Orroral Tracking Station, 2 Nov. 1976, *E.M. Canning 4116* (CBG); Brindabella Ranges 19.2 km from Picadilly Circus towards Mt Franklin, 1440 m., 29 Oct. 1986, *H. Thompson 767 and P. Ollerenshaw* (CBG).

VICTORIA: Bogong High Plains, near Wilkinson Lodge, 5400 feet, 6 Nov 1961, *T.B. Muir 2504* (MEL); Central Eastern Highlands, logging road c. 6 km NNE of Snowy Plains airstrip, Wonnangatta-Macalister R. divide, 1524 m, 7 Dec. 1970, *J.H. Willis* (MEL).

TASMANIA: Sandbanks Tier, 1280 m, 18 Mar. 1989, *A. Moscal 17292* (HO).

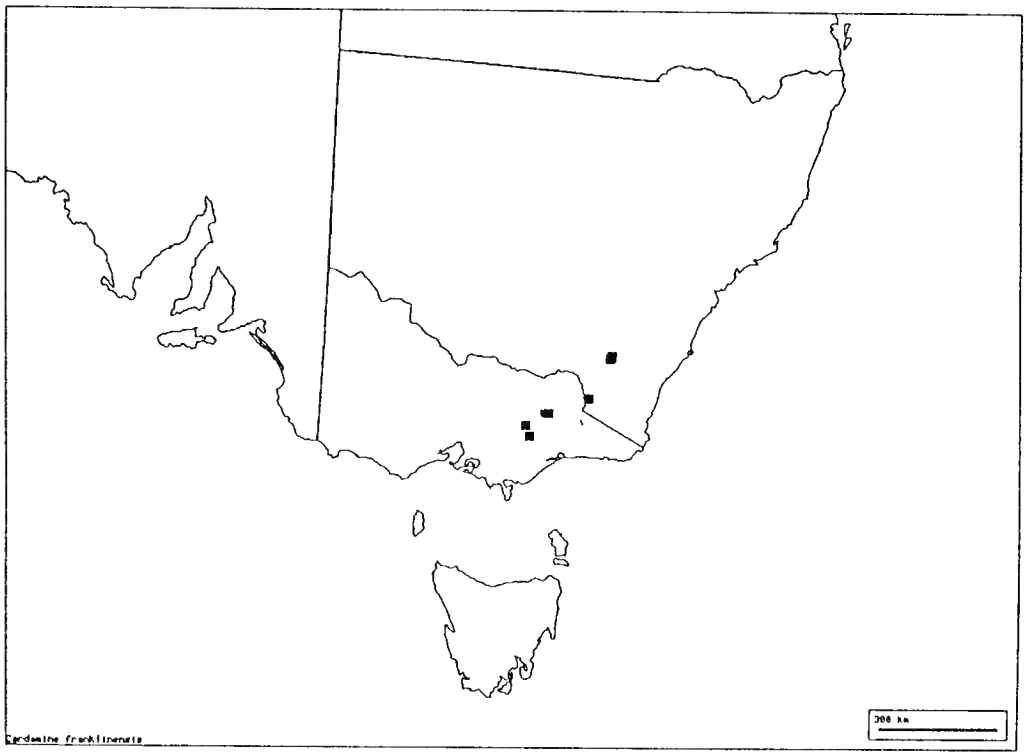

Fig. 8. Distribution of *Cardamine franklinensis*.

Cardamine astoniae I. Thomps., *sp. nov.*

Cardamini lilacinae Hook. affinis, caulibus stoloniferis, non rosulatis, foliis simplicibus vel pinnatis paucioribus differt.

HOLOTYPUS: Victoria, Snowfields, Bogong High Plains, between Rocky Valley Reservoir and Basalt Hill, Falls Creek area, 36°54'S, 147°18'E, 1650 m., 28 Dec. 1994, *Ian Thompson 84* (MEL).

Perennial herb, glabrous. *Roots* fine and fibrous. *Vegetative stems* long, growing horizontally, rooting at nodes, occasionally branching, turning upwards to produce an erect, usually unbranched flowering stem to c. 25 cm high. Leaves somewhat fleshy; basal leaves long-petiolate, simple or pinnate with 1-2 pinna pairs and a larger terminal pinna, to c. 15 cm long, mostly arising singly along vegetative stem, sometimes several clustered at base of flowering stem; terminal pinna ovate to elliptic, cuneate to cordate at the base; lateral pinnae orbicular to elliptic; cauline leaves usually several, pinnate to pinnatisect,the lateral lobes/pinnae angled strongly forwards. *Inflorescences* short many-flowered racemes. *Sepals* green, ovate, 3-4 mm long; petals broad, divided into limb and claw, 6-11 mm long, 3-6 mm wide, all white or pink on outside; stamens 6; mature style 1-3 mm long. *Siliquas* erect to sub-erect, 20-30 mm long, 2-2.5 mm wide; pedicels 10-20 mm long. *Seeds* oblong-elliptic, c. 2 mm long. (Fig. 9)

DISTRIBUTION AND CONSERVATION STATUS

Cardamine astoniae is recorded from several disjunct localities in Victoria, NSW and Tasmania. Areas include Barrington Tops National Park in the Northern Tablelands of NSW, the Southern Tablelands of NSW, several localities in the Alpine region of Victoria, notably Falls Creek and Mt Hotham areas, and from near Cradle Mountain in Tasmania. It is protected in National Parks. (Fig. 10)

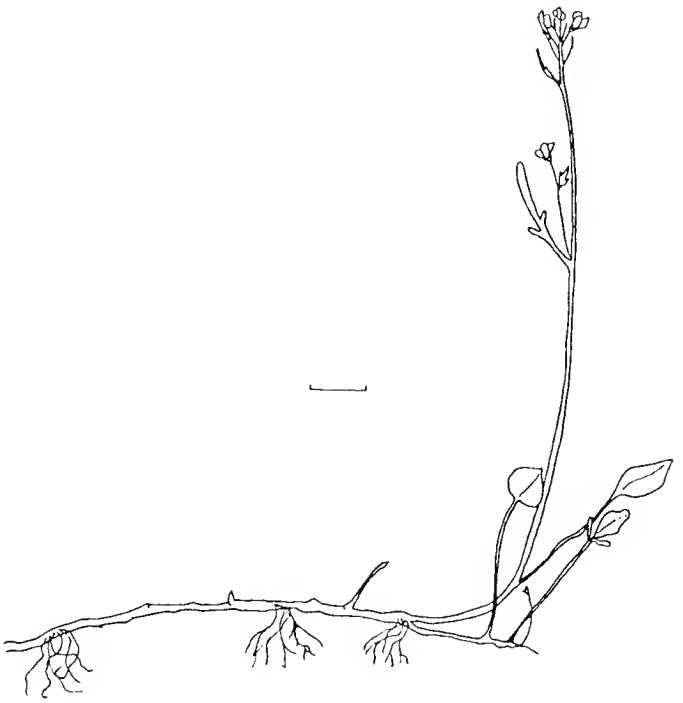

Fig. 9. *Cardamine astoniae*. Habit. From *Aston 182* (MEL).

HABITAT

Cardamine astoniae forms small to large colonies and grows amongst *Poa* or *Empodisma* tussocks in open, moist to boggy, alpine and sub-alpine environments.

ETYMOLOGY

Cardamine astoniae is named after Helen Aston, botanist and author of *Aquatic Plants in Australia*, who was the first to collect this species in Victoria.

NOTES

Cardamine astoniae has a distinctive habit which sets it apart from other larger-flowered species in Australia. It is inconspicuous when not in flower because it does not form a rosette of leaves. The horizontal stems grow through the litter layer with the lamina of the basal leaves just reaching above the level of the tussocks of grasses or rushes through which it creeps. The full extent of a single plant has not been ascertained but branches of the horizontal network of stems are up to 20 cm long. The flowers and fruits are similar to those of some larger-flowered alpine and sub-alpine populations of *C. lilacina* but the flowering stem is less commonly branched. The flowering period seems to be confined to late December and early January. Transplants from the field of *C. astoniae* maintain their horizontal growth habit.

REPRESENTATIVE SPECIMENS (16 specimens examined)

VICTORIA: N side of Mt Cope, Bogong High Plains, 1966, *A.C. Beauglehole 15508* (MEL); Timbarra R, Nunniong plateau, east Gippsland, 1964, *J.H. Willis* (MEL); At Pretty Valley, Bogong High Plains, 27 Dec. 1958, *H.I. Aston 182* (MEL); Bucketty Plain, *N.G. Walsh 3602* (MEL); Mt Loch 28 Dec. 1994, *I.R. Thompson 83* (MEL).

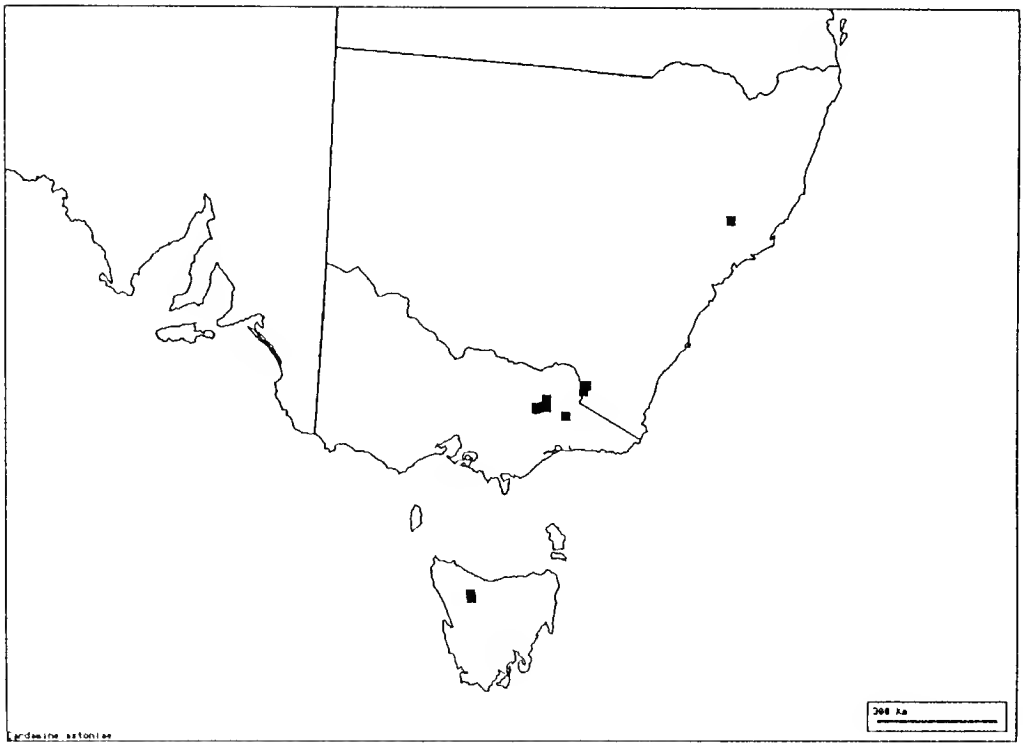

Fig. 10. Distribution of *Cardamine astoniae*.

NEW SOUTH WALES: S branch of Back Flat Creek, 0.25 mile [0.4 km] SE of Grey Mare Hut (upper Gechi R. district), 28 Dec. 1968, *A. Rodd 717* (NSW); Merritt's Creek, Kosciusko area, 10 Jan. 1960, *B.G. Briggs* (NSW); Saxby's Creek, 1 km NW of Carey's Peak, Barrington Tops, 29 Dec. 1969, *J. Pickard 821* (NSW).
TASMANIA: Leary's Corner, Middlesex plains, 17 Nov. 1986, *A. Moscal 13508* (HO).

KEY TO CARDAMINE GUNNII-LILACINA COMPLEX

The leaf blade of simple leaves is referred to here as the terminal pinna. The term pinna refers both to leaflets of pinnate leaves and to lobes of pinnatisect leaves when they resemble leaflets (i.e. if they are narrower towards the base).
Some species produce secondary inflorescences on flowering stems arising from the base of the primary stem or from cauline leaf axils. These inflorescences are typically fewer flowered than the primary inflorescence. In this key, the number of flowers per raceme refers to the primary inflorescence. Depauperate specimens will have fewer flowers per raceme.

1 Vegetative stems stoloniferous, basal leaves mostly arising singly at intervals along horizontal stem, the stem turning upwards to form an erect flowering stem ..... ***Cardamine astoniae***
1: Stems not stoloniferous, basal leaves forming a many-leaved rosette.....2

2 Plants spreading by means of robust underground stems which ascend to form new rosettes, bases of rosette leaves somewhat loosely arranged along stem, flowering stem simple, flowers large (petals greater than 8 mm long), white ..... ***Cardamine robusta***
2: Plants not spreading as above, bases of rosette leaves usually tightly clustered, flowering stem simple or branched, flowers variable in size (4-12 mm long), pink or white 3

3 Terminal pinna of basal leaves elliptic to ovate, cuneate at the base and lateral pinnae, if present, somewhat obovate, sessile and with attenuate bases, seeds 1.3-1.5 mm long, petals 4-6.5 mm long ..... ***Cardamine franklinensis***

3: Terminal pinna of basal leaves orbicular to ovate, often cordate at base, and most lateral pinnae distinctly stalked (petiolulate), seeds greater than 1.5 mm long, petals 4-12 mm long ..... ***Cardamine lilacina***

Acknowledgements

We are grateful to the National Herbarium of Victoria for the use of their facilities, to Neville Walsh of MEL for his assistance with the Latin diagnoses, to Dr. Tim Entwisle of MEL, and to Mali Moir for one of the accompanying illustrations. We are also grateful to the Directors/ Curators of AD, CANB, CBG, HO, K, MEL and NSW for the loan of specimens.

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A revision of the *Cardamine paucijuga* complex (Brassicaceae)

Ian R. Thompson

School of Botany, The University of Melbourne, Parkville, 3052, Victoria, Australia.

ABSTRACT

Four new species *Cardamine lineariloba* I. Thomps., *Cardamine microthrix* I. Thomps., *Cardamine papillata* I. Thomps. and *Cardamine moirensis* I. Thomps. are described and illustrated. *Cardamine paucijuga* is contrasted with the new species.

Introduction

Cardamine L. is a genus of about 200 species in the family Brassicaceae. The majority of species occur in temperate regions of northern and southern hemispheres. In Australia, a small number of endemic species are currently recognised, the majority of which are confined to south-eastern Australia, including Tasmania. They occur in moist habitats which include lowland swamps or watercourses, forests, sub-alpine woodlands and a variety of alpine habitats. Species described in this paper mostly occur at lower altitudes. Several introduced species in Australia are similar to, and can occupy similar habitats to, the native species although more commonly they occur in urban environments

Cardamine paucijuga was described by Turczaninov in 1854 based on a Western Australian specimen collected in 1848 by Drummond. This name was subsequently not recognised in Australian floras until resurrected by Hewson (1982). She included all native *Cardamine* from south-east Australia and Tasmania with petals less than 4 mm long in this species. Before this time, these taxa were identified as either *C. hirsuta* L. or *C. parviflora* L., two northern hemisphere species. Hewson described *C. pancijuga* as an annual, tap-rooted species, glabrous or sometimes hairy (but not with long, straight hairs like the introduced *C. hirsuta* and *C. flexuosa* With.) and with petals 2.5-3.5 mm long. Examination of herbarium specimens and evidence from field work and growth trials indicates the existence of four entities separable from *C. paucijuga* on the basis of foliar, stem, floral and inflorescence characters.

Taxonomy

Cardamine papillata I.Thomps., *sp. nov.*

Cardamini paucijugae Turcz. affinis, habitu humiliore, caulibus foliaccis minus, foliis caulium minoribus dissectis, racemis primariis brevioribus et floribus paucioribus, caulibus et pedicellis papillatis plerumque, stylo breviore plerumque differt.

HOLOTYPUS: Victoria, Maramingo Creek area, c. 4 km direct NE of Genoa P.O. 26 Dec. 1969, *A.C.Beauglehole 32819* (MEL).

Small annual to ?perennial herb, to 25 cm high, glabrous or papillate. *Tap-rooted. Stems* erect to ascending, slender, glabrous, sometimes minutely papillose, often branching from the base and from cauline leaf axils. *Leaves* thin; basal leaves long-petiolate, simple or pinnate with 1-2 pairs of lateral pinnae and a much larger terminal pinna, to 7 cm long, forming a persistent rosette; terminal pinna entire, orbicular, slightly cuneate or more often shallowly cordate at the base; lateral leaflets orbicular, short-stalked or sessile; cauline leaves 0-3, variable in shape, sometimes with papillose margins, the lowermost sometimes similar to basal leaves, simple or with 1-2 pinna pairs, otherwise

much reduced in length, usually less than 2 cm, and dissection, pinnate or pinnatifid and sessile. *Inflorescences* 1-10(-15) flowered racemes, often very few-flowered. *Sepals* ovate, green or purple-pigmented, 1.5-2.5 mm long, petals slender, cuneate to spathulate, 3-4.5 mm long, all white or pink on the outside; stamens 6; stigma sub-sessile or mature style up to c. 1 mm long. *Siliquas* erect to sub-erect, linear, 20-35 mm long, c. 1 mm wide, pedicels erecto-patent, 5-15 mm long, sometimes minutely papillose. *Seeds* elliptic, 1.0-1.2 mm long. (Fig. 1)

DISTRIBUTION AND CONSERVATION STATUS

Cardamine papillata has a scattered distribution in hilly to mountainous regions of South Australia, Victoria, New South Wales and Tasmania. In South Australia it is confined to hills east of Adelaide and southward down the Fleurieu peninsula. In New South Wales it has a somewhat disjunct distribution though this is possibly due to it being a small and inconspicuous species that is not commonly collected with its actual distribution being more continuous along the Great Dividing Range. Although not common it does not appear to be threatened. (Fig. 2)

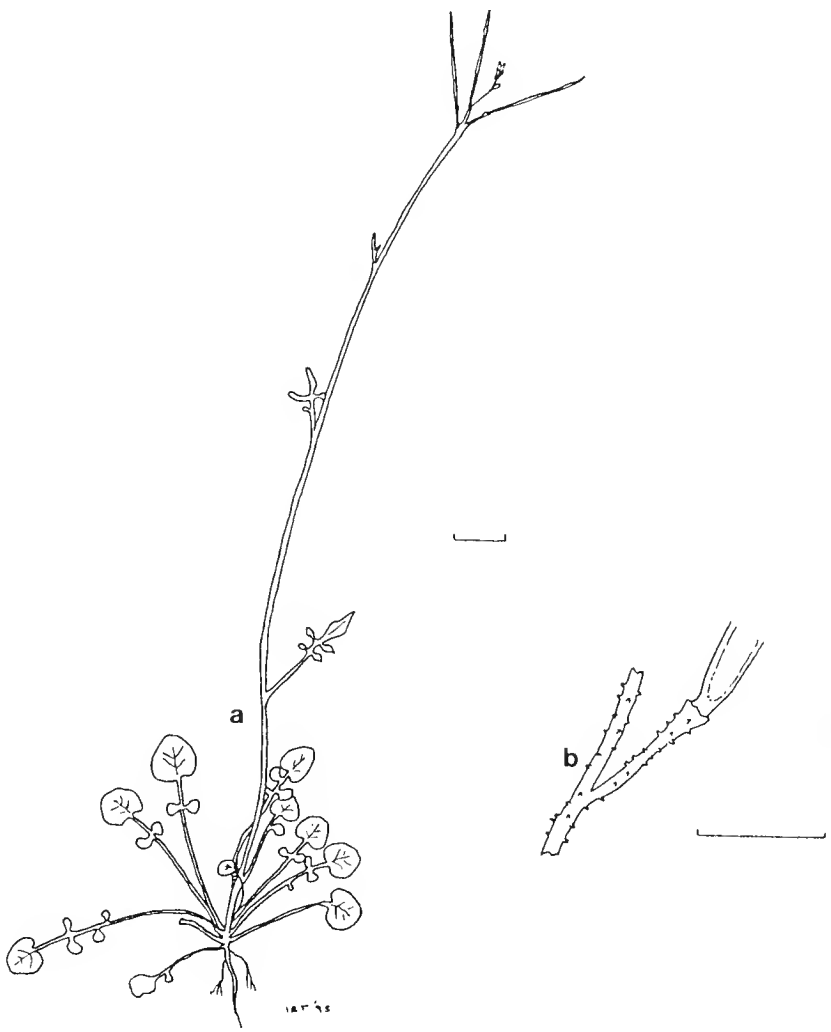

Fig. 1. *Cardamine papillata*. a - habit. b - pedicel and stem with papillae. From *Beauglehole 32819* (MEL).

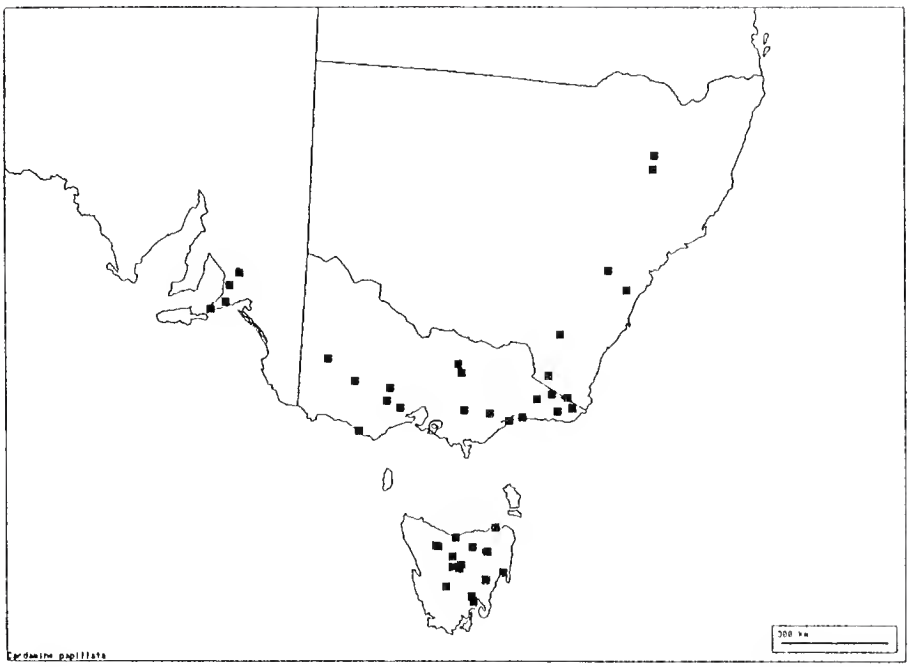

Fig. 2. Distribution of *Cardamine papillata.*

HABITAT

Cardamine papillata occurs most commonly in hilly, forested areas at lower altitudes, but has also been recorded from near coastal localities. It prefers moist, shaded areas often in rocky sites near streams and growing amongst mosses. Plants in these habitats are often tiny and produce primary racemes of only 1-3 flowers.

ETYMOLOGY

The specific epithet of the new species refers to the small papillae that often develop on the stems, pedicels and leaf margins of this species.

REPRESENTATIVE SPECIMENS (80 specimens examined)

SOUTH AUSTRALIA: Hindmarsh Tiers, Southern Lofty, 28 Aug. 1965, *J.B. Cleland* (AD).

VICTORIA: Bentley Plains road, 18 Feb. 1971 *A.C. Beauglehole 36799* (MEL); Little Hard Hills area east of Hall's road, Enfield Forest Park, 24 km SSW of Ballarat P.O., 23 Oct. 1978, *A.C. Beauglehole 61009* (MEL); Gippsland Lakes Coastal Park, SE of Rotamah Island 9 Sep. 1987, *I. Crawford 633* (MEL); Briagolong State Forest, 28 Sep. 1984, *A.C. Beauglehole 77461* (MEL); Port Campbell National Park between Crown of Thorns and the Grotto, 29 Oct. 1966, *A.C. Beauglehole 21519 and E.W. Finck* (MEL); Daylesford, 1880, *Wallace* (MEL).

NEW SOUTH WALES: Near Back (or Stony) creek, 0.5 km NW of Ramshead creek, 1981, *S.J. Forbes 662* (MEL); Attunga State Forest, 620 m., 27 Oct. 1990, *J.R. Hosking 186* (NSW); Warrabah National Park, 450 m., 9 Sep. 1987, *J.R. Hosking* (NSW); Beside Nimmitabel-Bega Rd., Glenbog State Forest, Southern Tablelands, 10 Dec. 1970, *A.N. Rodd 1577* (NSW).

TASMANIA: Clarke Is., 1893, J.H. Maclaine (MEL); Saltwater Lagoon, Friendly Beaches, 30 Dec. 1983, *A.M. Buchanan 2158* (HO); Florentine Valley, 12 Dec. 1952, *W.M. Curtis* (HO); Allwrights Lagoons, 5 km NNE of Waddamana, 882 m, 1 Dec 1990, *A. Moscal 20282* (HO).

Cardamine lineariloba I. Thomps. *sp. nov.*

Cardamini paucijugae Turcz. affinis, foliis simplicibus, linearibus ad spathulatos anguste, vel dissectis lobis lateralibus linearibus directis prorsum, lobo terminale longiore multo, racemis primariis brevioribus et floribus paucioribus, stylo breviore plerumque differt.

HOLOTYPUS: Victoria, Mt Arapiles SE slope along watercourse c. 1 mile [1.6 km] down from top, 22 Sep. 1968, *A.C. Beauglehole 28699* (MEL).

Small, annual herb, glabrous, to 25 cm high. *Fibrous rooted* with slender tap-root sometimes persisting. *Stems* slender, erect to ascending, usually much branched from the base and from cauline leaf axils. *Leaves* thin; basal leaves simple, to 6 cm long, persisting early in flowering; often entire, narrow oblanceolate the base very attenuate, occasionally shallowly lobed distally, sometimes pinnatisect with 1-several sessile linear lateral lobes angled forward and with a much longer almost linear terminal lobe, lobes entire, 0.3-2 cm long; cauline leaves mostly several, initial flowering stem often naked, similar to basal leaves, gradually reducing in size up the stem. *Inflorescences* mostly few-flowered racemes. *Sepals* green, ovate, 1.5-2 mm long; petals cuneate, 3-5 mm long, white, stamens 6; stigma sub-sessile or mature style up to 1mm long. *Siliquas* erect, linear, 9-20 mm long, c. 1 mm wide on erecto-patent pedicels 5-10 mm long. *Seeds* elliptic. c. 1.2 mm long. (Fig. 3)

DISTRIBUTION AND ECOLOGY

Cardamine lineariloba occurs in Victoria and South Australia extending from near Lake Terangpom in the south-west of Victoria north-westwards to the Little Desert region of Victoria and westwards to an area between Mt. Gambier and Naracoorte in South Australia. Not often collected. Its conservation status is uncertain. (Fig. 4)

HABITAT

Cardamine lineariloba occurs in lowland areas along stream banks and in seasonally wet lowland environments such as swamp margins.

ETYMOLOGY

The specific epithet of the new species refers to its leaf morphology.

REPRESENTATIVE SPECIMENS (23 specimens examined)

SOUTH AUSTRALIA: Bugle Range, 1848, *F. Mueller* (MEL); 5 km SW of Tarpeena (AD); 150 m S of exclosure, Calectasia Conservation Park, 29 Oct. 1986, *P. Gibbons 586* (AD).

VICTORIA: Between Lake Gnarpurt and Lake Terangpom, 24 km NE of Camperdown P.O., 7 Oct. 1977, *G.J. Hirth* (MEL); Saline flats near Mt William, Sept 1879, *D. Sullivan 31* (MEL); 3 km S of Dadswell

Fig. 3. *Cardamine lineariloba*. a — habit. b — leaf variant. a — from *Beauglehole 74495* (MEL), b — from *Beauglehole 28699* (MEL).

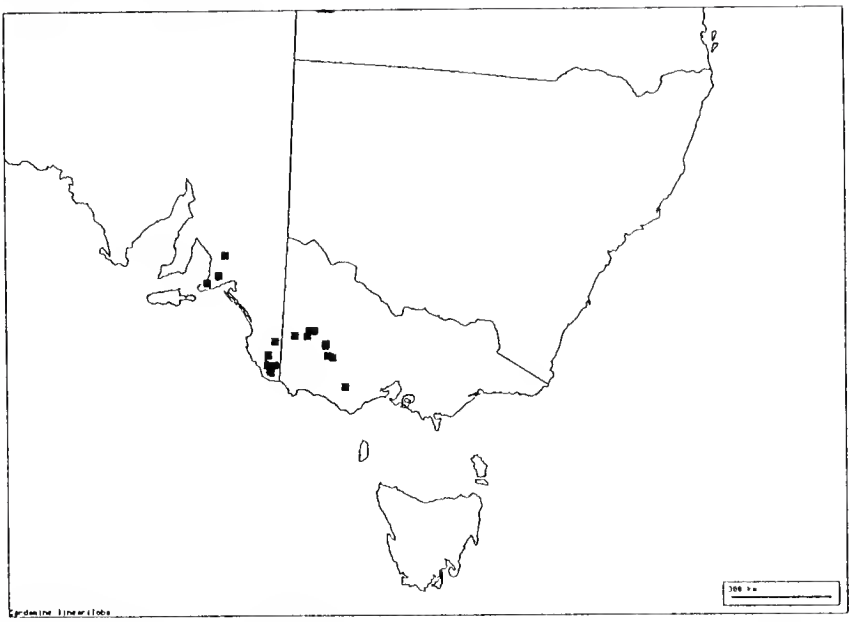

Fig. 4. Distribution of *Cardamine lineariloba.*

Bridge, Grampians National Park, 30 Aug. 1983, *A.C. Beauglehole 74495* (MEL); c. 4 km NE of Goroke P.O., Goroke State Forest, 4 Sep. 1986, *A.C. Beauglehole 83709* (MEL): Roadside adjacent to Darlot Swamp, NE of Horsham, 2 Sep. 1995, *I.R. Thompson 96* (MEL).

Cardamine microthrix I. Thomps., *sp. nov.*

Cardamini paucijugae Turez. affinis, robustiori, ereeta, eaulibus pilosis interdum, pinnis foliorum caulium margine ciliatis sparse, pinna terminali latiore, 3-9-lobata differt.

HOLOTYPUS: Vietoria, Clarke Lagoon Wildlife Reserve, north-east study area, 28 Oet. 1987, *A.C. Beauglehole 89710 and L.W. Huebner* (MEL).

Annual herb, to 30 em high. *Tap-root* slender to stout. *Stems* slender to robust, usually erect, glabrous to sparsely hairy, branehing from the base and from eauline leaf axils. *Leaves* thin; basal leaves long petiolate, mostly pinnate, to 8 em long,with 1-2 pinna pairs, forming a rosette, somewhat persistent; terminal pinna large, broadly ovate with a eordate base; lateral pinnae ovate, petiolulate; margins of pinnae entire, erenate or shallowly lobed; eauline leaves usually 2 or more, usually well-developed, pinnate with 1-2(-3) pairs of lateral pinnae; terminal pinna often broad, ovate, (3-)5-9 lobed, often deeply and acutely; lateral pinnae ovate, petiolulate, usually trilobed; few to many minute cilia on margins of some to all pinnae of eauline leaves. *Inflorescences* few to many-flowered raeemes, eommonly 8 or more per raeeme. *Sepals* green, ovate, e. 1.5 mm long; petals euneate e. 3 mm long, white; stamens 6; style 0.5 to 1 mm long. *Siliquas* sub-erect to ereet, sometimes erossing over the rachis, 20-30 mm long, e. 1mm wide on sub-erect pedieels 5-10 mm long. *Seeds* elliptic c. 1.2 mm long. (Fig. 5)

DISTRIBUTION AND CONSERVATION STATUS

Cardamine microthrix occurs in eastern Victoria and NSW in higher rainfall areas between thc Great Dividing Range and the eoast and has a disjunet distribution in South Australia. In Vietoria it is found in eentral to east Gippsland and in the far north-east of the state. In New South Wales it appears to be more widespread and has a scattered distribution from the far north to the far south of the state and its northerly distribution suggests that it is likely to occur in at least the far south of Queensland. In South Australia it is restrieted to hilly eountry to the east and south of Adelaide with an older record from Wellington near the mouth of the Murray. Its widespread distribution indicates that it is not threatened. (Fig. 6)

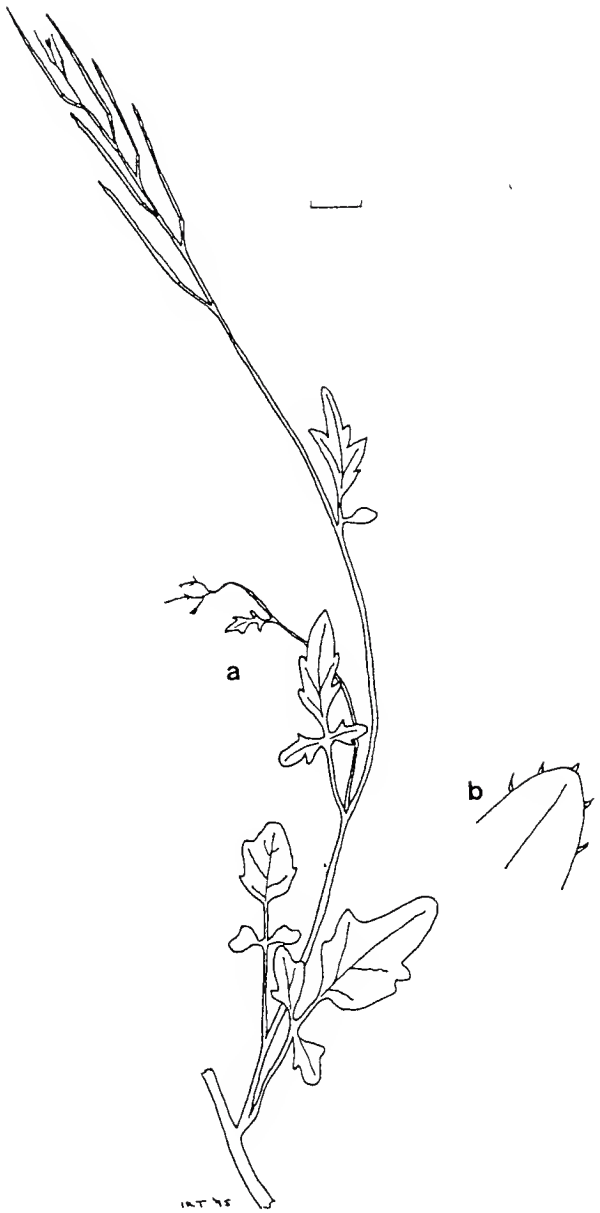

Fig. 5. *Cardamine microthrix*. a - habit. b - leaf margin x2. a-b from *Wilson* (MEL).

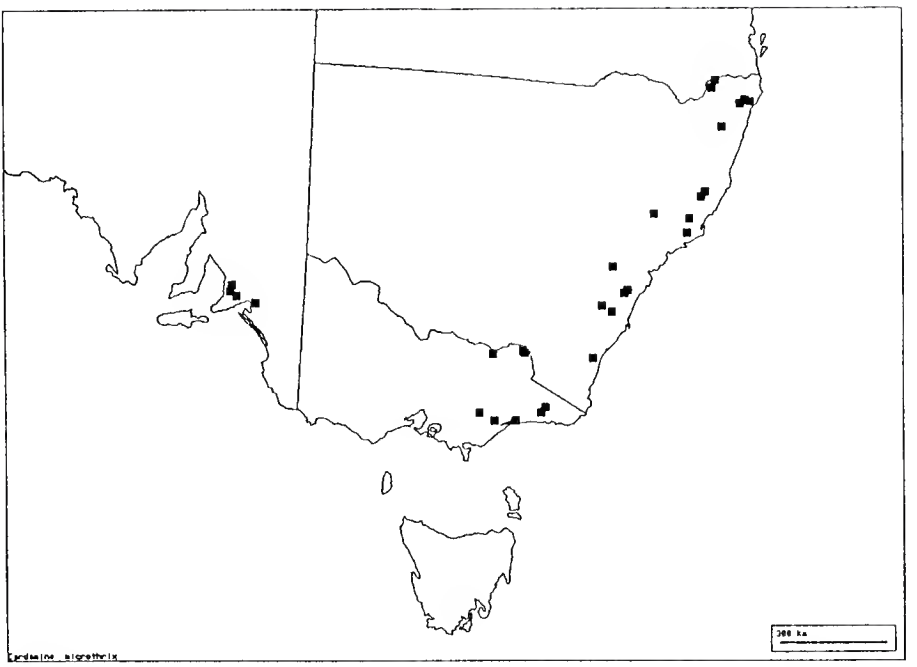

Fig. 6. Distribution of *Cardamine microthrix*.

HABITAT

Cardamine microthrix occurs along river, stream and lagoon banks and adjacent low-lying areas.

ETYMOLOGY

The specific epithet of the new species refers to the minute cilia present on pinna margins. This character is not present in other native species of *Cardamine*.

REPRESENTATIVE SPECIMENS (specimens examined)

SOUTH AUSTRALIA: Kaiser Stuhl, 1848, *F. Mueller* (MEL); Clarendon, 1882, *Tepper 697* (MEL); Manning Reserve, 30 km S of Adelaide, 24 Mar. 1971, *A.G. Spooner 1216* (AD).

VICTORIA: East Gippsland, Ellery Forest Block, Ferntree Creek near Sardine Creek road, 7 Jan. 1987, *G.E. Earl 388* (MEL); Colquhoun Regional Park, 29 Oct. 1984, *A.C. Beauglehole 79076 and J.R. Turner and J.G. Eichler* (MEL); Perry River Bridge area, 18 km ESE of Stratford P.O., 6 May 1985, *A.C. Beauglehole 79632 and J.R. Turner* (MEL); Cobberas National Park, 27 Oct. 1987, *A.C. Beauglehole 89511 and L.W. Huebner* (MEL).

NEW SOUTH WALES: Jembaicumbene Ck. 10 km SW of Braidwood, Alt. 660 m, 20 Oct. 1991, *B.J. Lepschi 598* (SYD, CANB, HO); Richmond River, 1876, *Fawcett*, (MEL); Tilba Tilba, 1881, *Miss Mary Bate 113*, (MEL); Devlin's Creek in Pennant Hills Park, Cheltenham, 2 Nov. 1982, *R.G. Coveny 11328* (MEL); Nepean River, Merangle, 13 Jan. 1968, *E.J. McBarron 14839* (NSW); Below Marshall Falls, 1 mile (1.6 km) S of Alstonville, North Coast, 25 Oct. 1961, *E.F. Constable* (NSW); Wollondilly River, S of Gibralter Rock, 6 km N of Marulan, 30 Oct. 1977, *L.A.S. Johnson 8384* (NSW); Sandy Creek, Bulahdelah-Booral Rd., north coast, 28 Sep. 1973, *A.N. Rodd 2353* (NSW).

Cardamine moirensis I. Thomps., *sp. nov.*

Cardamini paucijugae Turcz. affinis, pinna terminali foliorum basalium truneata ad cuneatam basi, foliis pinnis plus habentibus, pinnis lateralibus lobatis saepe, racemo primario breviore et floribus paucioribus, stylo breviore plerumque differt.

TYPUS: Victoria, eastern end of reserve on Ulupna Island, 10 km NW of Strathmerton in the Murray Valley, 35°51', 145°26', 20 Sep. 1978, *T.B. Muir 5965* (HOLOTYPUS: MEL; ISOTYPUS: NSW, HO, AD, CANB).

Small annual herb, to 30 cm high, glabrous. *Tap-root* slender to stout. *Stems* slender, erect to ascending, branching from the base and from cauline leaf axils, sometimes reddish at maturity. *Leaves* thin; basal leaves long-petiolate, to 8 cm long, pinnate with 1-4 pinna pairs, forming a few-leaved non-persistent rosette; terminal pinna ovate, trilobed, truncate to cuneate based, lateral pinnae entire or often with one or two lateral teeth, elliptic to narrow obovate; cauline leaves usually 3 or more, similar to basal leaves but shorter and with pinnae narrowing, becoming narrowly obovate to filiform and entire towards the summit. *Inflorescences* few-flowered racemes, mostly 2-8 flowered. *Sepals* green, ovate, 1.5-2 mm long; petals cuneate, 2-3.5 mm long, white; stamens 6, stigma sub-sessile or mature style to 1 mm long. *Siliquas* linear, 15-30 mm long, c. 1.0 mm wide, usually sub-erect on erecto-patent pedicels 5-15 mm long. *Seeds* elliptic, 1.0-1.2 mm long. (Fig. 7)

DISTRIBUTION AND CONSERVATION STATUS

Cardamine moirensis has been recorded mostly from the Riverina region in northern Victoria and southern NSW, between Rutherglen and Kerang, but also from an area in far western Victoria adjacent to the Little Desert and from Hattah-Kulkyne National Park (Murray Mallee). In NSW it has been recorded from Henty, Balranald and Mathoura. Although not protected in any National Parks, it does not appear to be immediately threatened assuming there are no major disturbances to the watercourses and swamps where it occurs.(Fig. 8)

HABITAT

Cardamine moirensis forms sparse to dense colonies in low-lying areas adjacent to streams and swamps. In northern Victoria it is commonly associated with *Eucalyptus camaldulensis* and *Rorippa laciniata*.

ETYMOLOGY

The specific epithet of the new species refers to the County of Moira (also now the Shire of Moira) which is the region in northern Victoria where it has most frequently been collected and which is approximately at the centre of its distribution in the Riverina region .

REPRESENTATIVE SPECIMENS (40 specimens examined)

NEW SOUTH WALES: Balranald, 1878, *Dr Lucas* (MEL); Dudal Comer Swamp, SW of Henty, 18 Oet. 1971, *B.G. Briggs 4390 and L.A.S. Johnson* (NSW).

VICTORIA: Blaek Swamp Wildlife Reserve, 25 Sep. 1985, *A.C. Beauglehole 80917* (MEL); Two Mile Swamp Wildlife Reserve, 6 Sep. 1985, *A.C. Beauglehole 80111* (MEL); Lake Moodemere Reserve, 25 Sep. 1985, *A.C. Beauglehole 80957* (MEL); Loeh Garry Wildlife Management Co-operative Area, 11 Sep. 1985, *A.C. Beauglehole 80317* (MEL); Yarriambiack Creek, County of Borung, 8 Oct. 1903, *F.M. Reader* (MEL); Ulupna Island Reserve in Murray Valley, 3 miles NW of Strathmerton, 7 Oet. 1969, *T.B. Muir 4706* (MEL); Far North West, Hattah Lakes National Park lake area, 21 Oet 1969, *G.W. Anderson* (MEL); Roadside adjaeent to Darlot Swamp, NE of Horsham, 2 Sep. 1995, *I.R. Thompson 97* (MEL).

NOTES

The type specimen of *C. paucijuga* was collected from the Swan River in south-west Western Australia in 1848 (Drummond 131). In 1867, *Cardamine* specimens differing from the type were collected from Warren River and Porongorup also in thc south-west of the statc). To my knowledge, there have been no further records of native *Cardamine* from WA since 1867. The type specimen consists of two sheets showing ten separate flowering and/or fruiting stems but information about basal leaf and root morphology is lacking. Thus, it has proved difficult to assign eastern Australian *Cardamine* to this species with certainty. Although specimens from Victoria, New South Walcs and Tasmania similar to the type of *C. paucijuga* (Fig. 9), but differing from the new species described above, are for now still assigned to *C. paucijuga*, they are somewhat polymorphic and some of the forms may not be *C. paucijuga sensu stricto*. Indeed, unless more information is forthcoming regarding thc nature of the Western Australian entities it may be wiser not to continue to include these remaining eastern Australian entities in *C.*

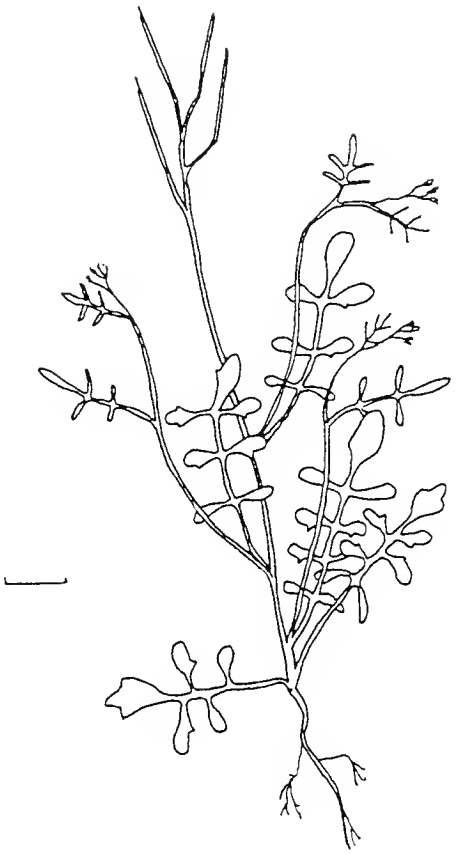

Fig. 7. *Cardamine moirensis*. a — habit. From *Beauglehole 64513* (MEL).

paucijuga. These forms oeeur in southern Vietoria, north-east Vietoria and from several localities in New South Wales and Tasmania (Fig 10).

Leaf morphology is the most important factor in distinguishing the four new species. In particular, leaves of *C. lineariloba* and *C. microthrix* are distinctive. The leafiness of stems, the tendeney of eauline leaves to reduee in size and dissection up the stem and the tendeney of basal leaves to persist is also important, espeeially in distinguishing *C. papillata* from the other speeies. The presenee of papillae in *C. papillata* and hairs on the stem and pinna margins in *C. microthrix* are also important eharaeters. *C. paucijuga* tends to have laxer stems and racemes than the other speeies and pressed speeimens of *C. paucijuga* often have more collapsed and shrivelled stems suggesting that its stems are more tender.

Cardamine moirensis differs from other species by having leaves with more pairs of lateral pinnae and pinnae that are more frequently lobed or dentate (exeept eompared to *C. microthrix*). Eastern Australian forms that remain in *C. paucijuga* have at least some basal leaves with a terminal pinna that is eordate at the base, whereas the terminal pinna of basal leaves of *C. moirensis* is never eordate. *Cardamine lineariloba*,

C. moirensis and *C. papillata* commonly have a very few-flowered (1-8) primary raceme, whereas *C. paucijuga* and *C. microthrix* commonly have primary racemes with 8 or more flowers. It is important to note that secondary raeemes and raeemes of depauperate speeimens tend to be fewer-flowered and so will not be as useful in

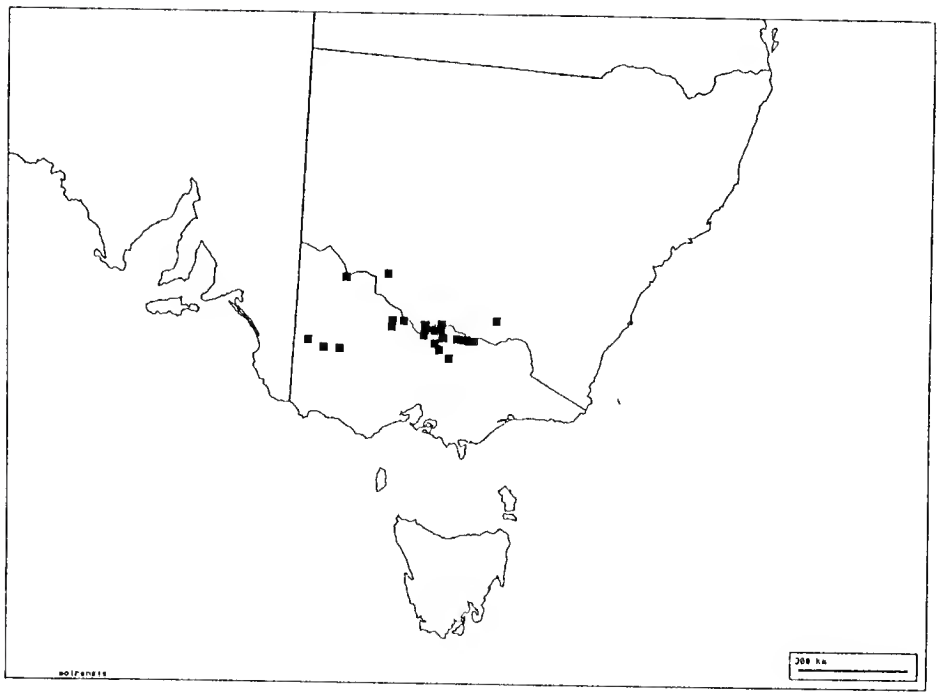

Fig. 8. Distribution of *Cardamine moirensis*.

distinguishing these species. Tasmanian specimens identified as *Cardamine* sp. aff. *corymbosa*, by Hewson (1982) are considered to be merely depauperate forms of *C. papillata*.

Cardamine lineariloba and *C. moirensis* appear to be true annuals whereas the capacity of the other three species to persist into a second season is uncertain. *Cardamine papillata* is able to persist into a second season when grown as a pot plant and there is evidence from pressed specimens that *C. paucijuga* can also persist.

Cardamine lineariloba and *C. moirensis* occur in lowland areas that are seasonally flooded or wet and are largely geographically separated from the other small-flowered native species. At several localities in the Wimmera (Western Victoria) they occur together. *Cardamine papillata*, *C. microthrix* and *C. paucijuga* occur in more elevated or near coastal sites.

Plants matching specimens from Taiwan, labelled as *C. flexuosa*, in MEL and AD occur in most capital cities of Australia. This form resembles typical *C. flexuosa* but is sufficiently different to warrant taxonomic recognition (see key below under *C. aff. flexuosa*) At this point I have been unable to determine if this has already occurred. It is mentioned here because it has often been misidentified as *C. paucijuga* in Australia. It occurs predominantly (?only) in urban areas or areas close to human habitation and therefore is presumed to be introduced. It has been recorded at numerous sites in the inner Melbourne area especially in municipal garden beds and in plant nurseries. It has also been recorded from nurseries in Canberra, Perth and Sydney, and from near Coffs Harbour. *Cardamine hirsuta* has also been misidentified as *C. paucijuga*. Presumably this has occurred because the sparsely hairy leaves of *C. hirsuta* can appear glabrous unless closely examined. The following key includes these and two other species in Australia with similar flower sizes that could be confused with the native species described above.

KEY TO *CARDAMINE PAUCIJUGA* AND ALLIES

The leaf blade of simple leaves is referred to here as the terminal pinna. The term pinna refers both to leaflets of pinnate leaves and to lobes of pinnatisect leaves when

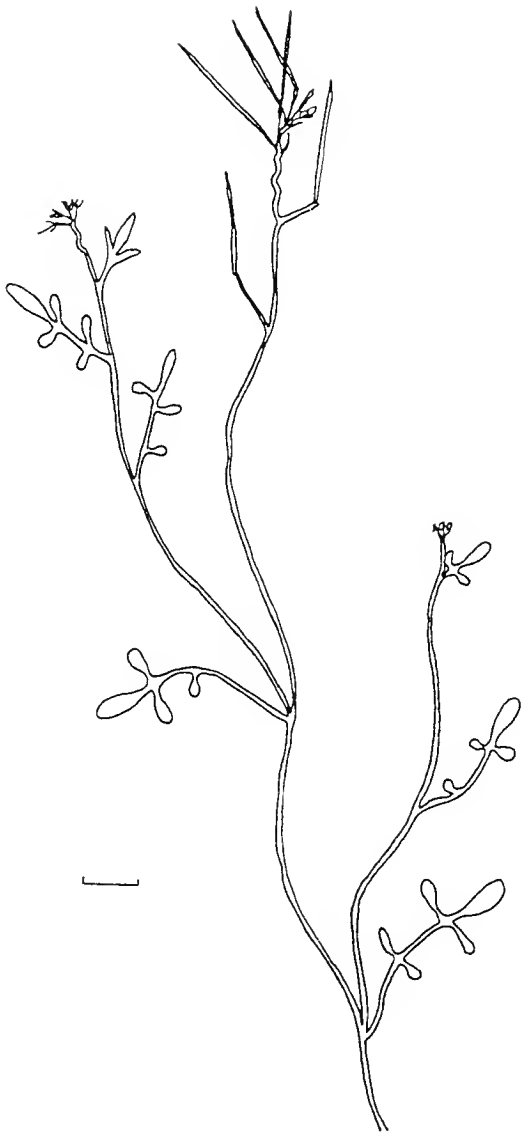

Fig. 9. *Cardamine paucijuga*. Habit,. from *Drummond 131* (G).

they resemble leaflets (i.e. if they are narrower towards the base).
All of these species produce secondary inflorescenees on flowering stems arising from the base of the primary stem or from cauline leaf axils. These inflorescences are often fewer flowered than the primary inflorescence. In this key, the number of flowers per raceme refers to the primary inflorescenee. Depauperate specimens will have fewer flowers per raceme than is usual for that species.

1 Leaves and/or stems with simple hairs (sometimes requires close inspection).....2
1: Leaves and stems glabrous or minutely papillose.....6

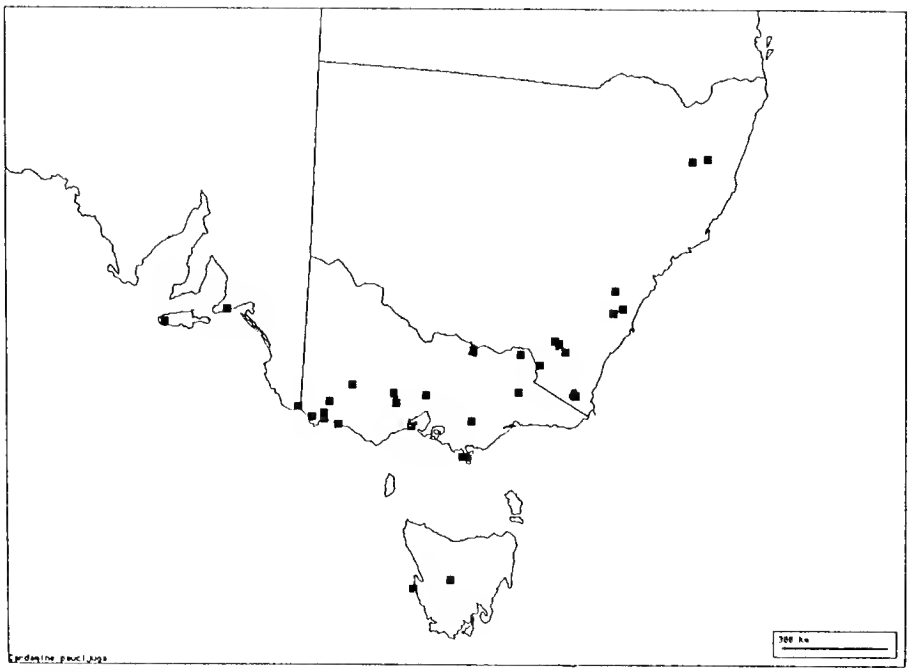

Fig. 10. Distribution of *Cardamine paucijuga*.

2 Upper surface of leaves glabrous (pinna margins may be sparsely hairy) 3

2: Upper surface of leaves with scattered hairs 4

3 Fruits sub-erect, inclined at less than 45° to rachis, terminal pinna of cauline leaves 3-9 lobed, basal leaves forming a rosette, seeds greater than 1.0 mm long, stems usually green and glabrous ..... ***Cardamine microthrix***

3: Fruits spreading to c. 60° to rachis, terminal pinna of cauline leaves entire to trilobed, basal leaves few, seeds less than 1.0 mm long, base of stems often reddish- purple and pubescent (weed of gardens and nurseries) ..... ****Cardamine* aff. *flexnosa***

4 Leaves mostly with 0-2 pairs of lateral pinnae, flowering stems not held erect, often not developed, pedicels commonly arising in whorls of 3 or 4, sometimes appearing to arise singly from the base, siliquas less than 1 mm wide, flowers often apetalous or with less than 4 petals (weed of gardens, two collections, from Melbourne and Hobart) ..... ****Cardamine corymbosa***

4: Leaves with 1-6 pairs of lateral pinnae, main flowering stem erect, pedicels alternating along rachis, fruits 1-1.5 mm wide, flowers usually 4 petalled 5

5 Stems glabrous to very sparsely hairy, stamens mostly 4, fruits glabrous or hairy, sub-erect, inclined at less than 45° to rachis and usually clearly overtopping open flowers in the same inflorescence, inflorescence rachis straight, cauline leaves 0-3, rarely more, leaf surface not obviously tuberculate ..... ****Cardamine hirsuta***

5: Stems sparsely to densely hairy, stamens mostly 6, siliquas glabrous and spreading, inclined at greater than 45° to rachis and not or hardly overtopping open flowers of the same inflorescence, inflorescence rachis often flexuose, cauline leaves 2 or more, leaf surface often tuberculate due to tubercle-based hairs ..... ***Cardamine flexnosa***

6 Seeds 0.8-1.0 mm long, basal leaves few, usually shorter than cauline leaves and not persisting, racemes many-flowered with siliquas erecto-patent to spreading,

inclined at 45-90° to rachis, flower buds often with several hairs (weed of gardens and nurseries) ..... ***Cardamine* aff. *flexuosa***

6: Seeds 1.0-1.3 mm long or more, plants not combining the above features (native species) 7

7 Basal and cauline leaves simple and linear to narrowly spathulate, or often pinnatisect with one to several short to long linear lobes projecting forwards from one or both sides of an otherwise narrow linear lamina, annual plant with few-flowered racemes ..... ***Cardamine lineariloba***

7: At least some leaves not as above 8

8 Terminal pinna of cauline leaves 3 or more lobed or toothed, lateral pinnae usually also lobed or toothed, most pinnae with several minute cilia on margins ..... ***Cardamine microthrix***

8. Terminal and lateral pinnae of cauline leaves entire or with one or two lateral lobes or teeth, pinnae not minutely ciliate on margins (but may be papillate) 9

9 Cauline leaves 0-3, size and dissection reducing markedly with successive leaves, lateral pinnae of basal and sometimes lower cauline leaves orbicular to elliptic, entire, basal rosette of leaves commonly persisting ..... ***Cardamine papillata***

9: Cauline leaves usually 2 or more, all pinnate to deeply pinnatisect with overall leaf shape and size changing only gradually with successive leaves, lateral pinnae of basal and cauline leaves elliptic to narrow obovate, entire or with one or two lateral teeth, basal leaves usually not persisting 10

10 Petals 2-3.5 mm long, white, terminal pinna of basal leaves usually distinctly trilobed, the base truncate to cuneate, mature style usually less than 1.0 mm long, at least some pinnae of cauline leaves lobed, inflorescences mostly 2-8 flowered, stems and pedicels of pressed specimens not markedly shrivelled ..... ***Cardamine moirensis***

10: Petals 3-6 mm long, white or pink, terminal pinna of basal leaves not trilobed, the base of at least some cordate, mature style up to 2.0 mm long, pinnae of cauline leaves all or mostly entire, inflorescences often more than 8 flowered, stems and pedicels of pressed specimens often collapsed and shrivelled ***Cardamine paucijuga***

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I am grateful to Prof. Pauline Ladiges of the University of Melbourne and to Dr. Tim Entwisle of MEL for their general assistance and to Neville Walsh of MEL for his assistance particularly with the Latin diagnoses. I am also grateful to the Directors/ Curators of AD, CANB, CBG, HO, K and NSW for the loan of specimens.

Reference

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A review of the *Erigeron pappocromus* Labill. complex

Stephen J. Forbes[1] *& Dennis I. Morris*[2]

[1] Kings Park and Botanic Garden, West Perth, 6151, Western Australia, Australia.
[2] Tasmanian Herbarium, G.P.O. Box 252C, Hobart, 7001, Tasmania, Australia.

ABSTRACT
The *Erigeron pappocromus* Labill. complex occurs in alpine and sub-alpine areas of south-eastern Australia. A review of the complex indentifies nine species. The generic status of the complex is discussed, and the complex assigned to *Erigeron* pending further studies.

Introduction

The first *Erigeron* collected in Australia was that found in 1792 at Recherche Bay in Tasmania by J.J.H. Labillardière during D'Entrecasteaux's voyage. The specimens provided the basis for the description of *Erigeron pappocromus* ('*pappocroma*') Labill., *Nov. Holl. Pl.* (1806). J.D. Hooker's explorations of Tasmania in 1840 resulted in the publication of four new species (*viz. E. bellidioides, E. gunnii, E. stellatus, E. tasmanicus*) based on Ronald Campbell Gunn's collections (Hooker, J.D. 1847). Hooker identified all but one of the Tasmanian species recognised in this paper under *(H)Aplopappus*. In 1856 in *Flora Tasmaniae*, Hooker reconsidered both the generic status and specific ranks within the *E. pappocromus* group. Hooker reduced two of the species published in 1847 to varieties, and transferred all taxa to *Erigeron*, thereby accepting Labillardière's original generic assignment.

This later and more conservative treatment of the *Erigeron pappocromus* group reflects the difficulty Hooker had in accommodating Australian mainland material sent by Mueller. '[*Erigeron gunnii*] very *much resembles E. Tasmanicum, but is covered everywhere with glandular pubescence, has much broader, often toothed leaves, with shorter petioles and stouter scapes, with fewer and longer bracteoles. Mueller sends a form of this species, with much stouter setae on the leaves than the Tasmanian specimens, and considers it a variety of E. Pappochroma. It does not at all resemble that species in general appearance, but without a very full series of specimens of subalpine plants, from many localities, it is not possible to ascertain the limits of their variation.*' The glandular pubescence, although a feature of *E. gunnii* (Tas.), *E. paludicola* (Vic., N.S.W.) and *E. nitidus* (Vic., N.S.W.), is not a feature of *E. bellidioides* (Tas., Vic., N.S.W.) although these species appear to be closely related.

In 1867 Bentham reviewed all of the Australian material available but he was unable to clearly distinguish the taxa recognised at that time. Bentham noted that, '*The ... varieties, all alpine, appear at first sight to be distinct species, but it is difficult to assign any precise limits to any of them.*' Bentham treated the typical form as a new variety (*E. pappochroma* var. *billardieri*) and followed Hooker in treating *E. bellidioides* and *E. gunnii* as a single variety (*E. pappochroma* var. *gunnii*). Of the mainland forms, Bentham recognised only *E. setosa* as *E. pappochroma* var. *setosa*.

Erigeron is now accepted as being masculine (ICBN 62.1 ex.1), although earlier authors treated the name as feminine or neuter. Paul Wilson (*pers. comm.*) argues that Labillardière's spelling of the specific epithet for *E. pappocroma* was intentional, .and further, that Labillardière was was treating '*pappocroma*' as an adjective, and giving the genus a feminine gender. Labillardière frequently modified Latin or Greek words to make names more euphonius. Paul Wilson cites the example of *Calytrix* rather than *Calythrix* or *Calycothrix*. J.D. Hooker (1847) changed the spelling to '*Pappochroma*' under the genus *Aplopappus*. Hooker apparently considered Labillardière's spelling

incorrect. The capitalisation of the first letter of the specific name suggests Hooker's view that the specific name was derived from a generic name.

Generic status

The absence of native *Erigeron* species from New Zealand, and the clear distinction between the *E. pappocromus* Group and the other Australian *Erigeron* species has resulted in speculation with regard to generic status (Hooker 1856; Given 1973). Whereas Given tentatively places *Erigeron pappocromus* in an assemblage including *Damnamenia, Celmisia, Pleurophyllum* and the macrocephalus species of *Olearia*, the analysis is a preliminary one. In particular the relationship between *Erigeron pappocromus* and South American and Northern Hemisphere *Erigeron* species requires examination. Examination of the alpine New Guinean *Erigeron* species recognised by Van Royen (1983) is also desirable.

Nesom (1994a) segregated *Erigeron setosus* and *E. stellatus* into the new genus *Lagenithrix* Nesom, and the remainder of the Australian species in the *E. pappocromus* complex into *Lagenopappus* (*viz. L. pappocromus* (Labill.) Nesom, *L. gunnii* (Hook.f.), Nesom and *L. tasmanicus* (Hook.f.) Nesom, and, by inference, *Erigeron* sp. A, *Erigeron* sp. B and *Erigeron* sp. C *sensu* Costin *et al.* 1979).

Although the generic status of the *E. pappocromus* complex requires further examination, the analysis by Nesom is unhelpful.

Nesom suggests '[*E. setosus and E. stellatus's*] *putative relationship to Erigeron is hypothesised to be superficial and they are recognised here as a separate genus.*' (*viz. Lagenithrix*), however, the analysis presented is unsatisfactory. The descriptions indicate that Nesom has observed only a few specimens. Characters used by Nesom to distinguish *Lagenithrix* include a tendency to produce 4-merous corollas in *E. stellatus* (although Nesom illustrates the typical 5-merous form), the smooth achenes with occasional viscid glands, and the short, thickened neck. The indistinct development of these features is of doubtful significance in determining new genera within the *E. pappocromus* complex. In particular, 4-merous corollas have not been observed in *E. stellatus*, the achenes are not smooth in *E. setosus, E. stellatus* and *E. trigonus*, and the 'thickened apical collar' is rather illusory and certainly not comparable to that of *Lagenifera*. Nesom notes additional characters including the stoloniferous habit, obovate to spathulate leaves, short white ligules, and sterile disk florets. The stoloniferous habit reflects the more exposed alpine habitat of *E. setosus* and *E. stellatus*, while the remaining characters are inconclusive. The fertility of the florets is difficult to establish as mature achenes are rarely produced, possibly reflecting harsh conditions at anthesis. Further study of the breeding systems is recommended.

In distinguishing *Lagenopappus* from *Erigeron*, Nesom suggests the importance of '*...achenial glands and other features that are more similar to Australian genera than true Erigeron.*' *Erigeron trigonus* lacks achenial glands, and the 'other features' remain obscure. The presence of a well-developed pappus and the broad-lanceolate or triangular style-branches, abaxially papillose, of the disk florets suggest links with northern hemisphere *Erigeron* and South American *Haplopappus*.

Further, Nesom suggests '*it is not clear that Lagenopappus and Lagenithrix are even most closely related to each other, their similarities apparently plesiomorphic in nature.*' Clearly Nesom has no field knowledge of the *E. pappocromus* complex. The common alpine habitat, and clear gradation in the series of species from *E. pappocromus* to *E. tasmanicus* and *E. stellatus* are strongly suggestive of a common origin. The generic boundaries between *Lagenopappus* and *Lagenithrix* outlined by Nesom reflect differences in habitat. The differences in dimensions suggested by Nesom are not supported by the material examined for the preparation of this paper.

Nesom (1994b) later amends the nomenclature of Australian *Erigeron* species referred to *Lagenoappus*). In this latter paper, Nesom accepts that the correct generic name for the *Erigeron pappocromus* complex is *Pappochroma* Raf. and considers *Pappochroma uniflora* Raf. the correct name for the type of the genus. Paul Wilson (*pers. comm.*) argues that the correct name for the type of this genus is '*Pappochroma*

pappocromum'. Rafinesque treated the genus as feminine, and presumeably considered that such a combination would result in the creation of a tautonym.. As the Greek 'chroma', is neuter, the name '*Pappochroma pappocromum*' is legitimate, and the name *Pappocroma uniflorum* '*uniflora*' is superfluous and accordingly, illegitimate.

Further studies of the intra and intergeneric relationships of species in the *Erigeron pappocromus* complex are required to justify the erection of a new genus or genera. Accordingly, this paper retains the use of *Erigeron* for the *Erigeron pappocromus* complex.

KEY TO THE TAXA WITHIN *ERIGERON PAPPOCROMUS* LABILL. COMPLEX

1 Leaves glabrous or if hairy with few marginal setae 2
1: Leaves ± covered with multicellular or sessile glandular hairs, margins ± ciliate with multicellular hairs 5

2 Leaves spathulate 3
2: Leaves elliptic or linear, sessile or petiole gradually expanding into lamina 4

3 Leaves flat or occasionally folded, thin (*herbaceous*), textured; margins crenulate; petiole gradually expanding into lamina (Tas.) ..... **1. *Erigeron pappocromus***
3: Leaves ± concave or folded, thick textured (*corneus* or *crassus*), margins ± entire, petiole distinct to 25 mm long (Alpine Tas. & Baw Baws) .. **6. *Erigeron tasmanicus***

4 Leaves elliptic; rosettes typically forming distinct colonies, only occasionally in alpine cushions; disk florets usually yellow (Alpine Tas.) ..... **7. *Erigeron. stellatus***
4: Leaves linear; rosettes solitary or forming colonies of a few plants in alpine cushions; disk florets usually purple (Alpine Tas.) ..... **8. *Erigeron trigonus***

5 Leaves spathulate, entire, yellowish-green, 5–15 mm long, 2–4 mm wide, petiole gradually expanding into lamina, setose with multicellular hairs 1–2.5 mm long; scape to 2 cm long (Alpine N.S.W.) ..... **9. *Erigeron setosus***
5: Leaves not setose, plants typically larger than above 6

6 Plants with spreading rhizomes in montane and alpine swamps; lower bracts on scape typically similar to leaves, scape slender, involucre narrow to 1.5 cm wide at maturity (Vic., N.S.W.) ..... **2. *Erigeron paludicola***
6: Plants with short rhizomes forming colonies; lower bracts on scape distinct from leaves, scape robust, involucre broad 1.2–2.5 cm wide at maturity 7

7 Leaves more or less cuneiform, with distinct border of multicellular acicular and glandular hairs 0.1–0.3 mm long, apex praemorse or ovate-crenate, expanding into lamina (Tas.) ..... **5. *Erigeron gunnii***
7: Leaves spathulate, lamina hirsute or glutinous, commonly crenate or denticulate towards apex 8

8 Leaves hirsute with multicellular hairs (Tas., Vic., N.S.W.). **4. *Erigeron bellidioides***
8: Leaves glutinous from more or less sessile glandular hairs (Vic., N.S.W.) ..... **3. *Erigeron nitidus***

Species descriptions

1. *Erigeron pappocromus* Labill., *Nov. Holl. Pl.* 2: 47 t.193 (1806) '*pappocroma*'

Pappochroma uniflorum Raf., *Fl. Telluriana* 2: 48 (1837) '*uniflora*' *nom. illeg.*, based on above; *Erigeron phlogotrichus* Spreng., *Syst. Veg.* 3: 520 (1826) *nom. illeg.*; *(H)Aplopappus pappocromus* (Labill.) Hook.f., *Hooker's London J. Bot.* 6: 111 (1847) '*Pappochroma*'; *Erigeron pappocromus* var. *billardierei* Benth., *Fl. Austral.*

3:494(1867) '*Billardieri*' *comb. illeg.* '*pappochroma*'; *Lagenopappus pappocromus* (Labill.) Nesom, *Phytologia* 76: 154 (1994).
TYPE: 'Habitat in capite van-Diemen' (Recherche Bay, Tasmania). LECTOTYPE (**here chosen**): [*J.J.H. de*] *Labillardière*, Nova Hollandia; MEL 594988; ISOLECTOTYPES: Specimen collect. Billardiere. com. Prof. Lehmann; MEL 619735, FI (p.p.); see note below.

Rhizomic herb forming ascending rosettes, typically distant although occasionally condensed. *Rhizomes* spreading widely, yellowish-green to brown, glabrous, 1–1.5 mm diameter. *Leaves* spathulate, entire, margins slightly thickened or revolute, crenulate, flat or partly folded, herbaceous, mid-vein apparent, secondary venation sometimes apparent below, 0.7–2(–4) cm long, 2–7(–11) mm wide, lamina glabrous or with a few marginal cilia, apex obtuse, base attenuate, petiole gradually expanding into lamina. *Inflorescence* a simple capitulum. *Scape* 1.5–15(–23) cm long, 0.5–1 mm diameter, sparsely scabrid towards apex with tubercle–based, acicular hairs to 0.1 mm and glandular hairs; bracts 2–6, distant, linear, 5 mm long towards apex. *Involucre* turbinate 1.1–1.5 cm wide, 0.6–1.0 cm high; bracts 26–32, imbricate, 2–3-seriate, linear, acute, apex ciliate or laciniate, often purplish; margins hyaline; outer bracts sparsely scabrid on basal margins with tubercle–based acicular hairs to 0.2 mm; inner bracts glabrous apart from apical setae. *Ray florets* 34–46, 1–3 seriate; corolla white or purplish with limb 3–4 mm long, 0.5 mm wide; style 3.5 mm long, style-arms: subulate 0.5–1 mm long. *Disc florets* 8–14; corolla narrowly funnelform, 5-lobed, 4.5 mm long; style 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white, 3–5 mm long. *Achenes* 2.5 mm long, flattened, smooth with distinctly thickened marginal ribs. (Fig. 1a)

DISTRIBUTION AND HABITAT
Tasmania; alpine and sub-alpine from 750–1200 m altitude, occasional in herb, grass and sedgelands, heaths, cushion plant communities, sphagnum bogs.

CONSERVATION STATUS
Erigeron pappocromus is restricted in habitat, and although uncommon appears to be adequately reserved.

NOTE ON LECTOTYPE
A photograph of the sheet of type material in Herbarium Webbianum (FI) indicates that this may be a mixed collection including *E. tasmanicus*. The material of Florence is not readily available for examination to resolve the ambiguity apparent from the photograph. Accordingly a lectotype has been selected from two sheets representing part of Labillardière's original collection and held at MEL. The first sheet is from Sonder's Herbarium, and the second sheet appears to be from Steetz's Herbarium. The former includes only fragmentary material, and accordingly the latter is selected as a lectotype. The specimen is in accordance with Labillardière's description.

SELECTED SPECIMENS
TASMANIA: Jubilee Range, alt. 886 m, 13 Jan. 1985, *A. Buchanan 5204* (HO); South West of Barn Bluff, alt. 1020 m, 15 Jan. 1989, *P. Collier 3933* (HO); West alpine Tasmania, 1894, *W.V. Fitzgerald* (MEL); Mt Field National Park, near eucalypt Lodge, alt. 1000 m, 24 Jan. 1983, *S.J. Forbes 1289* (CANB, HO, MEL); Hartz Mountains National Park, flat at head of Arve River on Hartz Road, alt. 800 m, 29 Jan. 1983, *S.J. Forbes 1312 p.p.* (AD, CANB, HO, MEL, NSW); 7 km NE Mt LaPerouse on walking track near campsite at head of tributary Many Falls Creek, alt. 760 m, 31 Jan. 1983, *S.J. Forbes 1348* (CANB, HO, MEL); Mt Wellington, *s.d., Gulliver* (MEL); Mt Wellington, 1 Jan. 1839, *R.C. Gunn 1149* (NSW); Summit of 'Cracrofts' on Middle Mount, between Franklin & Gordon Rivers, Macquarie Harbour, 6 Feb. 1847, *J. Milligan 875* (HO, MEL); Cockle Creek, Recherche Bay, Feb. 1857, *C. Stuart 1857* (MEL); Summit Mt Lepeyrouse, Mar. 1857, *C. Stuart 1855* (MEL).

2. *Erigeron paludicola* S.J.Forbes, *sp. nov.*

Erigeron pappocromus Labill. Form A; M. Gray in A.B. Costin *et al.*, *Kosciusko Alpine Fl.* 364 (1979). *Erigeron* sp. B; M.F. Porteners in G.J. Harden (ed.), *Fl. New South Wales* 3: 177 (1992).

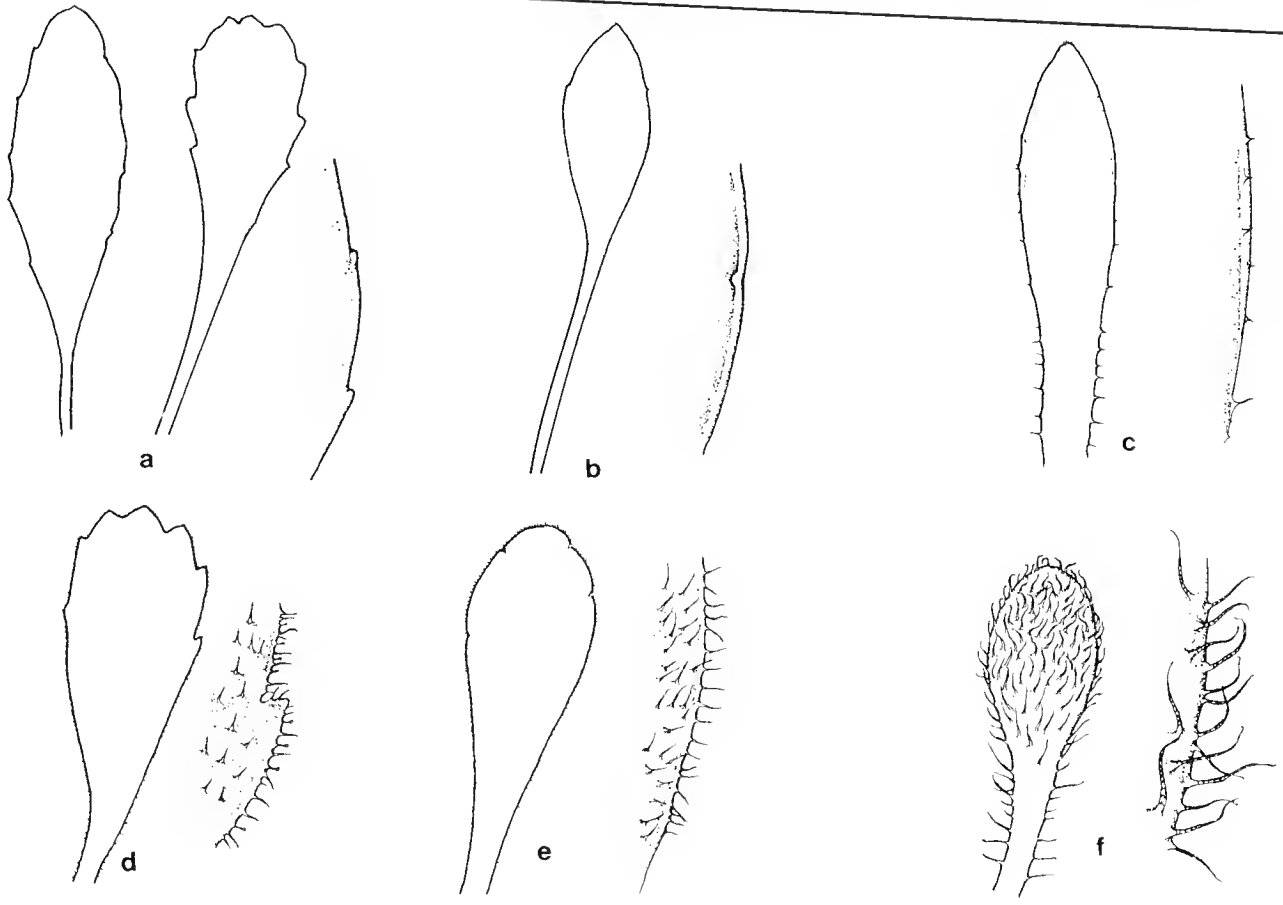

Fig. 1. Leaf shapes and leaf margin details. Top, from left to right: a — *Erigeron pappocromus* x 1.5; b — *E. tasmanicus* x 1.5; c — *E. stellatus* x 4.4); Bottom, from left to right: d. *E. gunnii* x 1.5; e — *E bellidioides* x 1.5; f — *E. setosus* x 3.

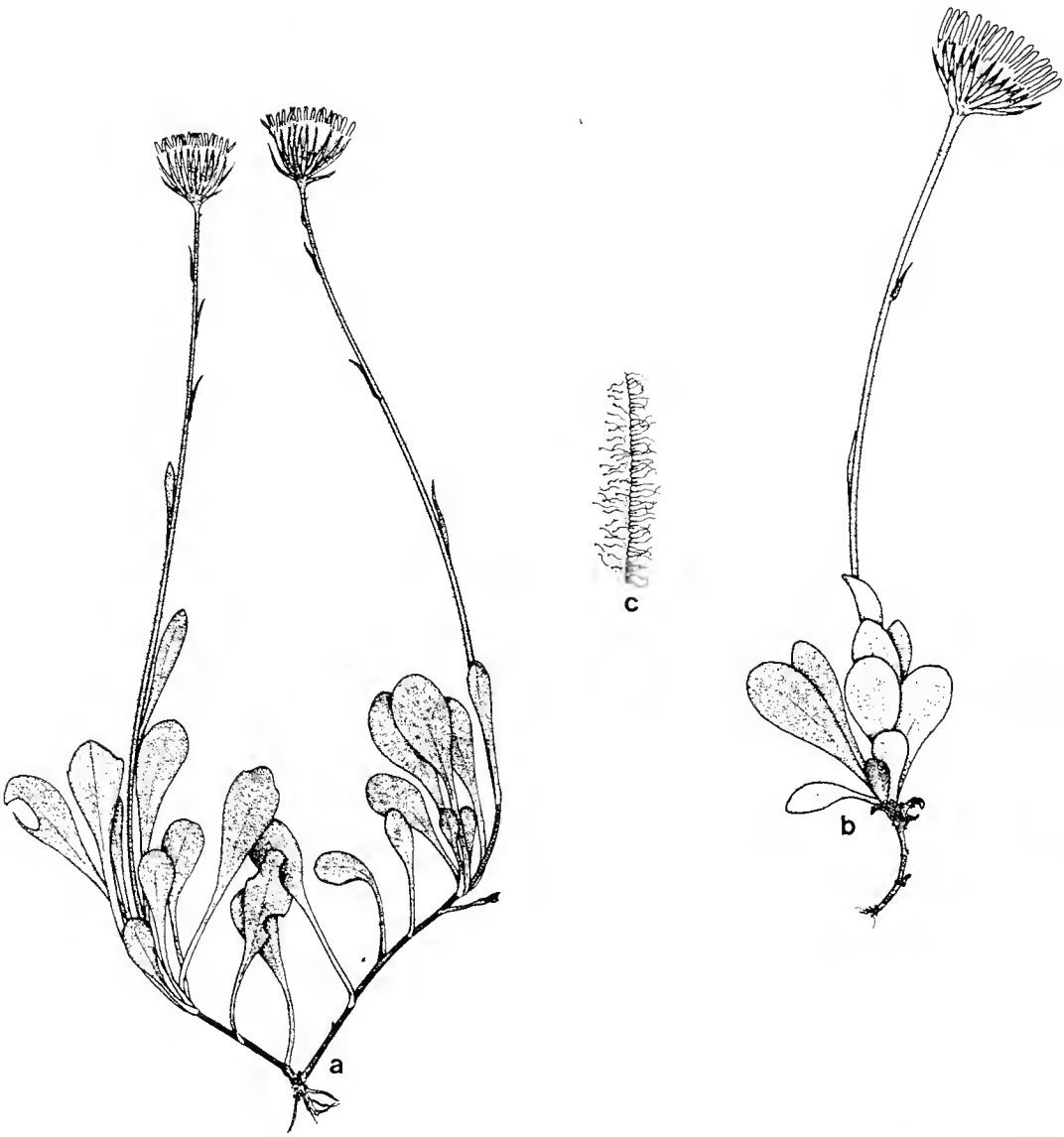

Fig. 2. *Erigeron paludicola* S.J.Forbes. From left to right: a — Whole plant x 0.85; b — Leaf margin detail x 11; c — Whole plant x 1.2.

Erigerontem bellidioidem simulans scd characteribus sequentibus differt. Herba rhizomatosa typice in turbario rosulas debiles ascendentes formans, inflorescentia 5–30 cm altitudine. Folia spathulata integra, flavo-virentia, 2–10 cm longitudine, 4–13 mm latitudine, apice obtuso, base attenuata, petiolo leniter in laminam expansa sparsim setosa pilis multicellularibus 0.2–0.3 mm longitudine et pilis sparsis glanduliferis ad 0.1 mm longitudine. Bracteae 2–4, secus pedunculum distantes, foliis similibus vel basin reductae, linearescentes, versus apicem 5–10 mm longitudine. Involucrum turbinatum 1.0–1.5 cm latitudine, 7–8 mm longitudine.

TYPE: Bogong High Plains, head of Cope Creek, 36°55'15"S, 147°17'00"E, alt. 1700 m, 2 Jan. 1983, *S.J. Forbes 1199*; HOLOTYPE: MEL; ISOTYPE: CANB.

Rhizomic herb forming weak, ascending rosettes. *Rhizomes* spreading widely, yellowish-green to brown, glabrous, 1–1.5 mm diameter. *Leaves* spathulate, entire, yellowish-green, 2–10 cm long, 4–13 mm wide, apex obtuse, base attenuate; petiole gradually expanding into lamina, sparsely setose with multicellular hairs 0.2–0.3 mm long with occasional glandular hairs to 0.1 mm. *Inflorescence* a simple capitulum. *Scape* 5–30 cm long, sparsely setose with multicellular hairs 0.2–0.3 mm long with occasional glandular hairs to 0.1 mm; bracts 2–4, distant along scape, similar to leaves or reduced at base, becoming linear, 5–10 mm long towards apex. *Involucre* turbinate 1.0–1.5 cm wide, 7–8 mm high; bracts 22–28, imbricate, 2-seriate, linear, acute, ciliate; margins hyaline; apices often purplish; outer bracts sparsely setose with multicellular hairs 0.2–0.3 mm long with occasional glandular hairs to 0.1 mm; inner bracts almost glabrous apart from apical cilia. *Ray florets* 22–51, 1–3 seriate; corolla white or purplish with limb 3–4 mm long, 0.5–1 mm wide; style 3.5 mm long; style-arms subulate, 0.4–0.8 mm long. *Disc florets* 6–11, hermaphroditic; corolla narrowly funnelform, 5-lobed, 4 mm long; style 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white, 4 mm long. *Achenes* 3 mm long, flattened, smooth with distinctly thickened marginal ribs. (Fig. 2a-c)

ETYMOLOGY
The specific epithet is derived from Latin and refers to the swampy habitat of the species.

DISTRIBUTION AND HABITAT
New South Wales and Victoria; in alpine and sub-alpine swamps on mainland Australia.

CONSERVATION STATUS
Erigeron paludicola is restricted in habitat, but is widely distributed and adequately reserved.

SELECTED SPECIMENS
NEW SOUTH WALES: Sources of the Hunter River, 1887, *Miss Carter* (MEL).
VICTORIA: Mt Buller, near top of 'Bourke Street', alt. 1650 m, 29 Jan. 1958, *T.B. Muir 354* (MEL); Mt Baw Baw, approx 1.8 km NE of Ski Village along track to Mustering Flat, 19 Feb. 1980, *P.S. Short 1115* (MEL); Mt Buffalo National Park, c. 2 km NE from the Horn, alt. 1480 m, 7 Feb. 1982, *N.G. Walsh 645* (MEL).

3. *Erigeron nitidus* S.J.Forbes, *sp. nov.*

a *Erigeronte bellidioide* circumlitione vernicosa foliorum e glandibus sessilibus exudante, pilis glandulosis et pilis acicularibus plerumque ad nervos pedunculos margines folii restrictis differt.

TYPE: Bogong High Plains, head of Cope Creek, 36°55'30"S, 147°17'00"E, alt. 1700 m, 1 Jan. 1983, *S.J. Forbes 1194*. HOLOTYPE: MEL; ISOTYPES: CANB, HO, NSW.

Fig. 3. *Erigeron nitidus* S.J.Forbes. Whole plant x 1.6.

Erigeron pappocromus Labill. Form B, M. Gray in A.B. Costin *et al.*, *Kosciusko Alpine Fl.* 364 (1979). *Erigeron* sp. A, M.F. Porteners in G.J. Harden (ed.), *Fl. New South Wales* 3: 177 (1992).

Rhizomic herb, often forming colonies comprising rosettes 4–10 cm in diameter. *Rhizomes* not spreading widely, reddish-brown, 2–4 mm in diameter. *Leaves* spathulate, 15–50 mm long, 6–15(–20) mm wide, multicellular glandular and acicular hairs usually restricted to margins and nerves; lamina surface viscid from sessile glands, commonly crenate or denticulate towards apex, base attenuate; petiole gradually expanding into lamina. *Inflorescence* a simple capitulum. *Scape* 2.5–17 cm long, glutinous, sparsely woolly with multicellular hairs; bracts 2–6, distant along scape, becoming linear, 5–10(–20) mm long towards apex of the scape. *Involucre* turbinate, 1.5–2.5 cm wide, 1 cm high.; bracts 25–42, 2–3 seriate, linear, acute, margins hyaline, ciliate towards apex, apices often purplish, viscid with sessile glandular hairs as well as occasional multicellular hairs. *Ray florets* 43–100; corolla white or purplish with limb 4–5 mm long; style 4.5 mm long; style-arms subulate, 1 mm long. *Disc florets* 12–40, hermaphroditic, corolla narrowly funnelform, 5-lobed, 5 mm long; style 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white, 5–6 mm long. *Achenes* 7 mm long, flattened, smooth with distinctly thickened marginal ribs. (Figure 3)

ETYMOLOGY

The specific epithet refers to the shiny, varnished leaf surface characterising this species.

DISTRIBUTION AND HABITAT

New South Wales and Victoria; in alpine grasslands and heathlands of mainland Australia where sympatric with *E. bellidioides*.

CONSERVATION STATUS

Erigeron nitidus is restricted in habitat, but is widely distributed and adequately reserved.

SELECTED SPECIMENS

NEW SOUTH WALES: Munyang Mountains, alt. 4–6,000 ft, Jan. 1855, *F. Mueller* (MEL); Mt Kosciusko, Jan. 1874, *F. Mueller* (MEL).

VICTORIA: Hotham Heights, 27 Mar. 1973, *A.C. Beauglehole 41693* (MEL); Upper Mitta Mitta, *F. Mueller* (MEL); Dargo High Plains, Lankeys Plain, 1 Jan. 1982, *N.G. Walsh* (MEL).

4. *Erigeron bellidioides* (Hook.f.) S.J.Forbes & D.I.Morris, *comb. nov.*
(H)Aplopappus bellidioides Hook.f., *Hooker's London J. Bot.* 6: 112 (1847); *Erigeron gunnii* var. *bellidioides* (Hook.f.) Hook.f., *Flora Tasman.* 1: 183, t.46B (1856).

Erigeron pappocromus var. *gunnii* auct. non (Hook.f.) Benth.: M.F. Porteners in G.J. Harden (ed.), *Fl. New South Wales* 3: 176 (1992). *Erigeron pappocromus* Labill. Form C, M. Gray in A.B. Costin *et al.*, *Kosciusko Alpine Fl.* 364 (1979).

TYPE: Middlesex Plains, Tas., *Gunn 692*; HOLOTYPE: K photograph seen, see note.

Rhizomic herb, often forming spreading colonies of rosettes 4–10 cm in diameter. *Rhizomes* not spreading widely, reddish-brown, 2–4 mm in diameter, clothed in scale-like deltoid bracts 1–2 mm long, narrowly triangular, 6–10 mm at base of rosette. *Leaves* spathulate, 15–80 mm long, 5–15(–20) mm wide; lamina hirsute with multicellular hairs 0.1–1 mm long with a few sessile glands, commonly crenate or denticulate towards apex, base attenuate, margins ciliate, petiole gradually expanding into lamina. *Inflorescence* a simple capitulum. *Scape* 1.5–30 cm long, at first woolly with multicellular hairs to 0.5 mm. *Bracts* 2–6, distant along scape, becoming linear, 5–10(–20) mm long towards apex of scape. *Involucre* turbinate, 1.5–2.5 cm wide, 1 cm high; bracts 25–45, 2–3 seriate, linear, acute, margins hyaline, ciliate towards apex, apices often

purplish, viscid with sessile glandular hairs as well as occasional multicellular hairs. *Ray florets* 33–100; corolla white or purplish with limb 4–5 mm long; style 4.5 mm long, style-arms subulate, 1 mm long. *Disc florets* 8–40, hermaphroditic; corolla narrowly funnelform, 5-lobed, 5 mm long; style 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white, 5–6 mm long. *Achenes* 5.5–7 mm long, flattened, smooth with distinctly thickened marginal ribs. (Fig. 1e)

DISTRIBUTION AND HABITAT

New South Wales, Victoria, Tasmania; in alpine and sub-alpine grasslands and heathlands of mainland Australia where sympatric with *Erigeron nitidus*, and extending from alpine to montane grasslands and heathlands in Tasmania.

CONSERVATION STATUS

Erigeron bellidioides is restricted in habitat, but is widely distributed and adequately reserved.

NOTES

The two large specimens on the left of the holotype sheet are apparently from Middlesex Plains – the remainder of the material on the sheet is from St Patricks River. The holotype may include specimens illustrated by Fitch in Flora Tasmaniae t.46 B as *E. gunnii*, although the details are apparently of the holotype of *E. gunnii*.

SELECTED SPECIMENS

NEW SOUTH WALES: Barrington Tops National Park, Polblue Swamp, 12 Dec. 1989, *A. Anderberg & A-L. Anderberg 7189* (MEL, S); Mt Kosciusko, Jan. 1874, *F. Mueller* (MEL).

VICTORIA: Bogong High Plains, Cope Creek, alt. 1700 m, *S.J. Forbes 1192* (CANB, HO, MEL, NSW); Moroka Valley, Mar. 1861, *F. Mueller* (MEL); Bogong High Plains, headwaters of Cope Creek, 1.75 km NE Mt Cope, alt. 1690 m, 11 Dec. 1980, *H. van Rees 222* (MEL); Mt Baw Baw, 1.8 km NE of Ski Village along track to Mustering Flat, 19 Feb. 1980, *P.S. Short 1118* (MEL); Mt Buffalo National Park, snow plain at base of Mt McLeod, alt. 1400 m, 27 Jan. 1982, *P.S. Short 1390* (MEL); 'Diggers Holes', Nunniong Plateau., alt. 4,500 ft, 5 Jan. 1949, *N.A. Wakefield 2635* (MEL).

TASMANIA: Iris River-Cradle Valley Road crossing, 10.5 km by road N Waldheim, 20 Jan. 1983, *S.J. Forbes 1240* (CANB, HO, MEL); Ben Lomond National Park, ski-slopes near summit Legges Tor, alt. 1550 m, 4 Feb. 1983, *S.J. Forbes 1395* (CANB, HO, MEL, NSW); Diddleum Plains, St Patricks, 16 Nov. 1844, *R.C. Gunn 692* (NSW);

5. *Erigeron gunnii* (Hook.f.) F. Muell. ex Hook.f. *Flora Tasman.* 1: 183 (1856).

(H)Aplopappus gunnii Hook.f., *Hooker's. London J. Bot.* 6: 111 (1847); *Erigeron pappocromus* Labill. var. *gunnii* (Hook.f.) Benth., *Fl. Austral.* 3: 494 (1867); *Lagenopappus gunnii* (Hook.f.) Nesom, *Phytologia* 76: 154 (1994); *Pappochroma gunnii* (Hook.f.) Nesom, *Phytologia* 76:426 (1994).

TYPE: Mount Wellington, Tasmania; 31 Jan. 1840, *R. Gunn 1151*; HOLOTYPE: K photograph seen; ISOTYPE: NSW 275467; POSSIBLE ISOTYPE: MEL.

Rhizomic herb, often forming colonies, in rosettes 2–10 cm in diameter. *Rhizomes* not spreading widely, reddish-brown, 2–4 mm in diameter clothed in scale-like triangular or broad triangular bracts, c. 2.5 mm long, triangular to narrow-triangular c. 3 mm long at base of rosette. *Leaves* cuneiform, 10–50 mm long, 5–15 mm wide, lamina glabrous to sparsely scaberulous from tubercle-based deciduous hairs, margins with distinct border of multicellular acicular and glandular hairs 0.1–0.3 mm long, or occasionally with acicular hairs only, apex praemorse or ovate-crenate, commonly, base attenuate, petiole usually distinct and gradually expanding into lamina. *Inflorescence* a simple capitulum. *Scape* 3–15(–25) cm long, at first woolly with multicellular acicular and glandular hairs to 0.3 mm. *Bracts* 2–6(–7), distant along scape, becoming linear, 5–10 mm long towards apex. *Involucre* turbinate, 1.2–2.0 cm wide, 0.8–1.0 cm high. *Bracts* 25–30, 2–3 seriate, linear, acute, margins ciliate towards apex, margins hyaline, apices often purplish, sparsely setose with multicillular glandular hairs 0.2–0.3 mm long, inner bracts almost

glabrous apart from apical setae. *Ray florets* 35–95; corolla white or purplish with limb 4 mm long. *Style* 4.5 mm long, style-arms subulate, 1 mm long. *Disc florets* 12–29, hermaphroditic, corolla narrowly funnelform, 5–lobed, 3.5 mm long. *Style* 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white 5 mm long. *Achenes c.* 3.5 mm long, flattened, smooth with distinctly thickened marginal ribs. (Fig. 1d)

SELECTED SPECIMENS

TASMANIA: 1 km ENE of Nevada Peak, alt. 1190 m, 25 Feb. 1990, *P. Collier 4551* (HO); Mt. Wellington near pinnacle, 28 Jan. 1983, *S.J. Forbes 1308* (MEL); Hartz Mountains National Park, near summit Hartz Peak, alt. 1230 m, 1 Feb. 1983, *S.J. Forbes 1354* (CANB, HO, MEL, NSW); Ben Lomond National Park, Ski Village, alt. 1480 m, 3 Feb. 1983, *S.J. Forbes 1387* (HO, MEL); Mt Wellington, Diamond Springs above Ploughed Field, 27 Mar. 1878, *J. Milligan 1132* (MEL); Snowdrift Tarn, Snowy Range, 22 Mar. 1983, *A. Moscal* 2181 (HO).

DISTRIBUTION AND HABITAT

Alpine and sub-alpine grasslands and heathlands of Tasmania.

CONSERVATION STATUS

Erigeron gunnii is restricted in habitat, but is widely distributed and adequately reserved.

NOTE

The holotype includes preliminary drawings for the details illustrated by Fitch in *Flora Tasmaniae* t. 46B as *E. gunnii*. The mature plants illustrated are probably referable to *E. bellidioides*.

6. *Erigeron tasmanicus* (Hook.f.) Hook.f., *Fl. Tasman.* 1: 183, t.46A (the right-hand figure) (1856).

(H)Aplopappus tasmanicus Hook.f., *Hooker's. London J. Bot.* 6: 110 (1847); *Erigeron pappocromus* Labill. var. *oblongatus* Benth., *Fl. Austral.* 3: 494 (1867); *Lagenopappus tasmanicum* (Hook.f.) Nesom, *Phytologia* 76: 154 (1994); *Pappochroma tasmanica* (Hook.f.) Nesom, *Phytologia* 76: 426 (1994).

TYPE: Mount Wellington, Tasmania, *Gunn 1150*; HOLOTYPE: K, photograph seen; POSSIBLE ISOTYPE: NSW 51741.

Rhizomic herb forming ascending rosettes, typically distant although occasionally condensed. *Rhizomes* spreading widely, yellowish-green to brown, glabrous, 1–3 mm diameter. *Leaves* spathulate, entire, margins thickened, sometimes distantly and minutely serrulate, often more or less concave or folded, bright-green, with only mid–vein apparent, (0.7–)1–5(–7) cm long, 3–9 mm wide, lamina at first sparsely and minutely scabrid with tubercle based multicellular hairs to 0.1 mm long and occasional sessile glands, apex acute or occasionally emarginate, base attenuate; petiole gradually expanding into lamina, occasionally with a few distant marginal cilia at the base. *Inflorescence* a simple capitulum. *Scapes* 1.5–15 cm long, sparsely scabrid with tubercle-based acicular hairs to 0.1 mm. *Bracts* 2–6, distant along scape, similar to leaves at base, becoming linear, 5 mm long towards apex. *Involucre* turbinate 1.1–1.5 cm wide, 0.6 cm high; bracts 24–40, imbricate, 2–3-seriate, linear acute, apex minutely ciliate; margins hyaline, apices often purplish, outer bracts sparsely scabrid with tubercle-based, acicular hairs to 0.2 mm, inner bracts glabrous apart from apical cilia. *Ray florets* 23–55, 1–3 seriate; corolla white or purplish with limb 3 mm long, 0.5–0.6 mm wide; style 3.5 mm long; style-arms subulate 0.5–1 mm long. *Disc florets* 4–14, hermaphroditic; corolla narrowly funnelform, 5-lobed, 3.5 mm long; style 3.5 mm long; style-arms narrowly elliptic, 1 mm long. *Pappus* capillary, white, 3 mm long. *Achenes* 2.5–3 mm long, flattened, smooth with distinctly thickened marginal ribs. (Fig. 1b)

SELECTED SPECIMENS

VICTORIA: Baw Baw National Park, Currawong Flat, alt. 1465 m, 5 Dec. 1981, *N.G. Walsh 682* (MEL); Baw Baw Plateau, Currawong Flat, alt. 1470 m, 26 Feb. 1991, *N.G. Walsh 3052* (MEL); Baw Baw Plateau, Pauciflora Flat, alt. 1450 m, 26 Feb. 1991, *N.G. Walsh 3056* (MEL).

TASMANIA: 1 km N of Resevoir Lake, alt. 750 m, *D.G. Adams 30* (HO); West alpine Tasmania, 1894, *W.V. Fitzgerald* (MEL); Cradle Mountain National Park, Crater Peak lookout-Horse Trail intersection, 3 km NNW summit Cradle Mountain, alt. 1240 m, 19 Jan. 1983, *S.J. Forbes 1219* (CANB, HO, MEL); Hartz Mountains National Park, flat at head of Arve River on Hartz Road, alt. 800 m, 29 Jan. 1983, *S.J. Forbes 1312 p.p.* (AD, CANB, HO, MEL, NSW); Mt Wellington near pinnacle, 28 Jan. 1983, *S.J. Forbes 1307* (CANB, HO, MEL); Hill One, 5 km NNE Mt La Perouse on walking track, alt. 980 m, 31 Jan. 1983, *S.J. Forbes 1337* (MEL); Ben Lomond National Park, ski village, alt. 1480 m, 3 Feb. 1983, *S.J. Forbes 1386* (CANB, HO, MEL).

DISTRIBUTION AND HABITAT

Tasmania and Victoria, on the Baw Baw Plateau; in alpine and sub-alpine grassland, herbfield and heathland.

CONSERVATION STATUS

Erigeron tasmanicus is restricted in habitat, but is widely distributed and adequately reserved in Tasmania. The species is rare in Victoria, and although adequately reserved, appears vulnerable due to rarity

7. *Erigeron stellatus* (Hook.f.) W.M. Curtis, *Students Fl. Tas.* Pt.2: 463 (1963).

(H)Aplopappus stellatus Hook.f., *Hooker's. London J. Bot.* 6: 112 (1847); *Erigeron tasmanicus* var. *stellatus* (Hook.f.) Hook.f., *Flora Tasman.* 1: 183, t.46A (the left–hand figure)(1856); *Erigeron pappocronus* var. *stellatus* Benth., *Fl. Austral.* 3: 494 (1867); *Lagenithrix stellata* (Hook.f.) Nesom, *Phytologia* 76: 151 (1994).

TYPE: Mountains (? Hampshire Hills), Tas., *Gunn 279*; HOLOTYPE: K, photograph seen, the top three specimens on the sheet are referable to this collection; POSSIBLE ISOTYPE: NSW 275470

Rhizomic herb forming stiff rosettes. *Rhizomes* spreading, yellowish-green to brown, glabrous, scales triangular 2–3 mm long, 1–2.5 mm diameter. *Leaves* narrowly elliptic, occasionally broadest above the middle or spathulate, entire, yellowish-green, 1–3 cm long, 1.5–3.5 mm wide, apex obtuse with a few apical setae 0.3–0.8 mm long, base attenuate, sessile or petiole gradually expanding into lamina, lower margin with a few tubercle-based multicellular setae 0.3–0.8 mm long, and occasional multicellular glandular hairs to 0.1 mm, otherwise glabrous. *Inflorescence* a simple capitulum. *Scapes* 5–6.5 cm long, sparsely setose with multicellular hairs 0.2–0.3 mm long with occasional glandular hairs to 0.1 mm. *Bracts* 2–4, distant along scape, similar to leaves at base, becoming linear, 5–10 mm long towards apex. *Involucre* turbinate 0.6–0.8(–1.5) cm wide, 1.0–1.6 cm high; bracts 22–28, imbricate, 2-seriate, linear, acute, apex ciliate often purplish; margins hyaline; outer bracts sparsely setose with multicellular hairs 0.2–0.3 mm long with occasional glandular hairs to 0.1 mm; inner braets almost glabrous apart from apical cilia. *Ray florets* 22–51, 1–3 seriate; corolla white or purplish with limb 3–4(–5) mm long, 0.5–1.5 mm wide; style 3.5 mm long; style-arms subulate, 0.4–0.8 mm long. *Disc florets* 6–11(–28) hermaphroditic, corolla narrowly funnelform, 5–lobed, 4 mm long; style 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white, 3–4 mm long. *Achenes* 2.5–3 mm long, flattened, sparsely setose with occasional sessile glandular hairs, and with distinctly thickened marginal ribs. (Figs 1c & 4e)

SELECTED SPECIMENS

TASMANIA: Mt Counsel, western slopes, highest point, north, in view from Melaleuca Settlement, alt. 2,400 ft, 19 Mar. 1954, *M. Davis 1465* (MEL); Cradle Mountain National Park, summit Cradle Mountain, alt. 1540 m, 19 Jan. 1983, *S.J. Forbes 1220* (CANB, HO, MEL); SE slope of Great Dome, alt. 1200 m, 22 Jan. 1983, *S.J. Forbes 1266* (MEL); Mt Sorell, Macquarie Harbour, alt. 3000 ft, 25 Jun. 1847, *J. Milligan 874* (MEL); Mt Gaffney, alt. 480 m, 14 Jan. 1986, *A. Moscal 11678* (HO); Mt Field National Park, low saddle between top of ski tow and Mt Mawson, alt. 1280 m, 14 Feb. 1989, *N.G. Walsh 220* (MEL).

DISTRIBUTION AND HABITAT
Tasmania; on exposed alpine areas of Tasmania although absent from Ben Lomond and Mt Wellington, and occuring as low as 480 m in the south west.

CONSERVATION STATUS
Erigeron stellatus is restricted in habitat, but appears adequately reserved.

8. *Erigeron trigonus* S.J.Forbes & D.I.Morris, *sp. nov.*

a *Erigeronte stellato* foliis 5–14 mm longitudine, linearibus, ± trigonis, apiculatis, marginibus non nisi prope basin pectinato–ciliatis et floseulis disei proprie atropurpeis differt.

TYPE: Hamilton Crags, Ben Lomond, Tas., 41°43'S, 147°41'E, 1460 m, 5 Jan. 1992, *A. Moscal 22287*; HOLOTYPE: HO; ISOTYPE: MEL, NSW.

Rhizomic herb forming distant rosettes. *Leaves* 5–14 mm long, glabrous, coriaceous, shining, linear, trigonous to almost terete, becoming channelled on drying, flattened below; margins of the flattened part pectinate-ciliate, the cilia septate; apex purple, narrowing ± abruptly to a stout colourless apiculum up to 0.5 mm long, this eroding with age. *Inflorescence* a simple capitulum. *Scape* 2.3–5 cm high, purple, glabrous or with scattered glandular or eglandular septate hairs or a combination of both. *Bracts* 1–3(–7) linear, 2–4 mm long. *Involucre* turbinate, *c.* 10 mm wide; bracts 25–35, 2–3 seriate, 3–5.5 mm long, purple, margins glabrous or minutely ciliate. *Ray florets* 20–30; corolla white or tipped purple or pink, limb *c.* 4.5 mm long, tube with a few weak hairs at throat; style *c.* 2 mm long; style-arms 1 mm long. *Disc florets* 5–12, purple, corolla, narrow-funnelform, 5-lobed, 5 mm long, with a few weak hairs at the midpoint. *Pappus* capillary, white, 3.5–4 mm long. *Achenes* 2–2.5 mm long, flattened, sparsely hairy with a denser tuft of hairs at the base. *Mature achenes* not seen. (Fig. 4a-d)

ETYMOLOGY
The specific epithet refers to the characteristically three-sided leaves of *Erigeron trigonus*.

DISTRIBUTION AND HABITAT
Tasmania; in alpine heath and feldmark, often amongst cushion plants.

CONSERVATION STATUS
Erigeron trigonus is restricted in habitat and rare. Although adequately reserved the species appears vulnerable due to rarity.

SELECTED SPECIMENS
TASMANIA: Newdegate Slopes, 4 May 1930, *H.F. Comber* 2635 (HO); Eliza Plateau, 22 Jan. 1983, 1200 m, *S.J. Forbes 1263* (MEL); Eliza Plateau, 22 Jan. 1983, 1200 m, *S.J. Forbes 1264* (MEL); Mt Field National Park, low saddle between top of ski tow and Mt Mawson, alt. 1280 m, 14 Jan. 1989, *N.G. Walsh 2281* (MEL).

9. *Erigeron setosus* (Benth.) M. Gray, *Contr. Herb. Aust.* 6: 1 (1974).

Erigeron pappocronus var. *setosus* Benth., *Fl. Austral.* 3: 494 (1867); *Lagenithrix setosa* (Benth.) Nesom, *Phytologia* 76: 150 (1994).

TYPE: 'In vertice montis Koseiusko, loeis glareosis, 6000–6500 ft radius albus vel rubellus, 1 Jan. 1855, F. Mueller. Munyang Mountains, Victoria, *F. Mueller* 6000–6500 ft'. LECTOTYPE (*fide* M. Gray, 1974): MEL 1012236.

Rhizomic herb produeing crowded rosettes. *Rhizomes* spreading, yellowish-green to brown, glabrous, scales triangular, 2–3 mm long, 1–2.5 mm diameter. *Leaves* spathulate,

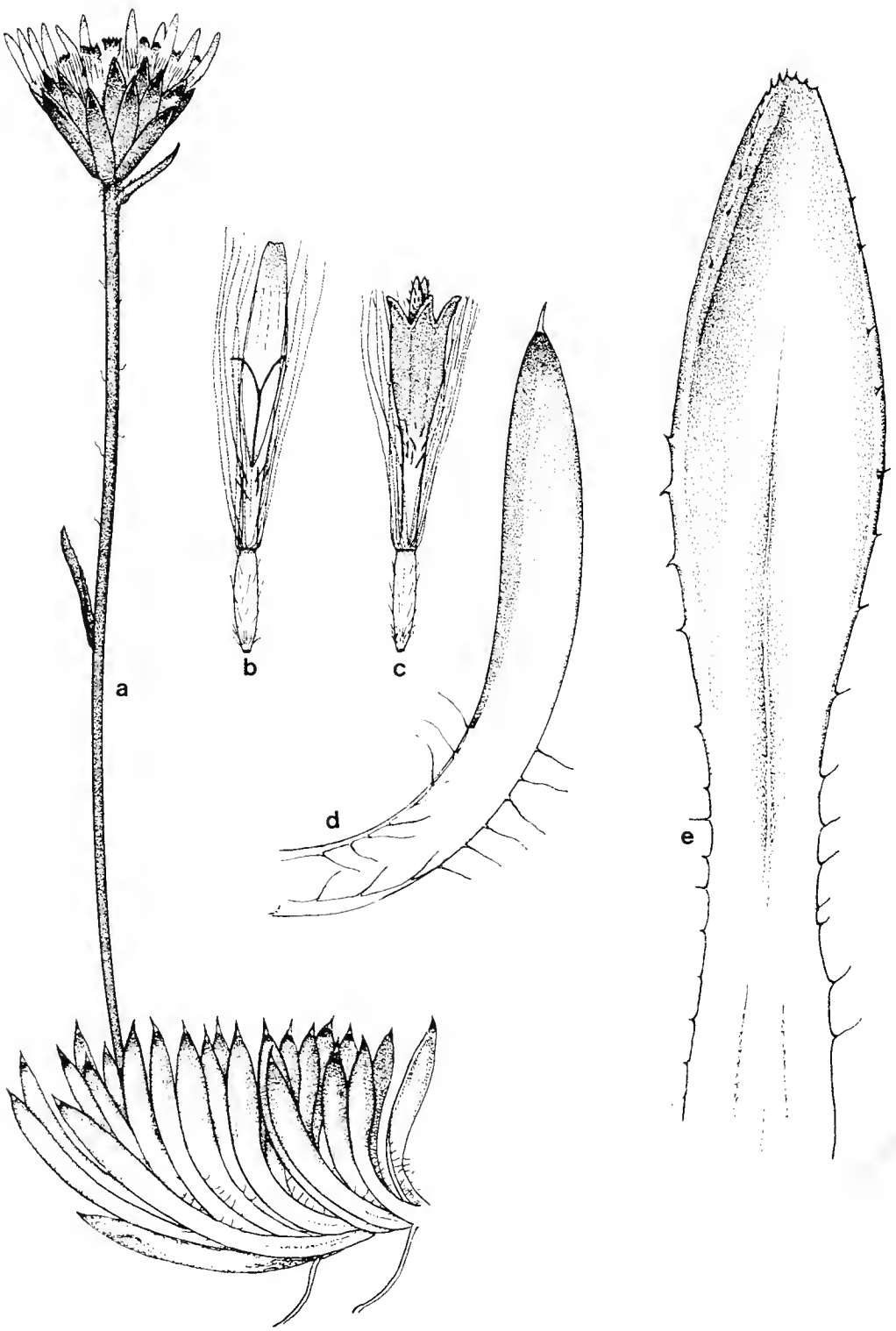

Fig. 4. *Erigeron trigonus* S.J.Forbes & D.I.Morris. From left to right: a — Whole plant x 3; b — Ray floret x 7.5; c — Dise floret x 7.5; d — Leaf x 7.5; e — *E. stellatus* leaf x 7.5.

entire, yellowish-green, 5–15 mm long, 2–4 mm wide, apex obtuse, base attenuate, petiole gradually expanding into lamina, setose with multicellular hairs 1–2.5 mm long. *Inflorescence* a simple capitulum. *Scapes* to 2 cm long, sparsely setose with multicellular hairs 1–2.5 mm long with occasional glandular hairs to 0.1 mm. *Bracts* linear. *Involucre* turbinate 0.6–0.8 cm wide, 1.0–1.6 cm high; bracts 19–32, imbricate, 2-seriate, linear, acute, apex ciliate, often purplish; margins hyaline; outer bracts sparsely setose with multicellular hairs 0.2–0.3 mm long with occasional glandular hairs to 0.1 mm; inner bracts almost glabrous apart from apical setae. *Ray florets* 32–38, 1–3 seriate; corolla white or purplish with limb 2.5–3 mm long, 0.5 mm wide; style 3 mm long; style-arms subulate 0.4–1 mm long. *Disc florets* 6–9, hermaphroditic; corolla narrowly funnelform, 5-lobed, 3 mm long; style 3.5 mm long; style-arms narrowly elliptic 1 mm long. *Pappus* capillary, white, 4 mm long. *Achenes* 3 mm long, flattened, smooth or sparsely glandular, with distinctly thickened marginal ribs. (Figure 1 f)

DISTRIBUTION AND HABITAT

Kosciusko Plateau, New South Wales; in alpine herbfields.

CONSERVATION STATUS

Erigeron setosus is restricted in habitat, but appears adequately reserved.

SELECTED SPECIMENS

NEW SOUTH WALES: 1 km ENE Rams Head, W of Mt Kosciusko foot track from summit of Thredbo Village main chairlift, alt. 2100 m, 12 Feb. 1985, *S.J. Forbes 2816* (MEL); Etheridge Range, 1 km SSW of Seamans Hut, alt. 2012 m, 17 Jan. 1972, *J. Thompson 1344* (MEL, NSW); Hedley Tarn below Blue Lake, Kosciusko Plateau, 5 Feb. 1946, *J.H. Willis* (MEL).

Acknowledgements

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Muelleria 9: 191–193 (1996)

A new species of *Gynatrix* (Willd.) Alef. (Malvaceae) from eastern Victoria

N.G. Walsh

National Herbarium of Victoria, Royal Botanic Gardens, Birdwood Avenue, South Yarra, 3141, Victoria, Australia.

ABSTRACT

Gynatrix macrophylla is described as a new species distinguished from *G. pulchella* by its larger, more densely indumented leaves, and larger flowers and fruit. Its distribution, habitat and conservation status are outlined.

Introduction

In preparing an account of the Malvaceae to be published in Volume 3 of the *Flora of Victoria*, it became apparent that there are 2 distinct species of *Gynatrix* in Victoria. The opportunity is here taken to name a previously undescribed taxon prior to the Flora's publication later this year.

Taxonomy

Gynatrix macrophylla N.G.Walsh *sp. nov.*

a *Gynatrix pulchella* (Willd.) Alef. foliis majoribus, cordatis magis, pagina abaxiali stellato-tomentosa dense et aequaliter, floribus majoribus (calyce 4.5-6.5 mm longo, petalis 6-10 mm longis in floribus masculis; calyce 3.5-4.5 mm longo, petalis 2-3 mm longis in floribus femineis), fructibus majoribus (mericapiis 5-6 mm longis, seminibus 3-3.5 mm longis) distinguitur.

TYPUS: Victoria, North-east, Howqua River, 5 km south-east from Mt Timbertop, 28 May 1987, *N.G.Walsh 1845* (HOLOTYPUS: MEL; ISOTYPI: CANB, PERTH).

Dioecious shrub or small tree to c. 5 m high. *Leaves* ovate to broad-ovate, (4-)6-12(-20) cm long, (2.5-)4-9(-14) cm wide, deeply cordate at base, and often with the basal lobes overlapped; margins crenate or crenate-serrate; grey or whitish beneath, with the lower lamina obscured by a dense, even layer of stellate trichomes; upper lamina green to grey-green, glabrescent or with sparse to dense stellate trichomes persisting. *Male flowers*: *calyx* cupular, 4.5-6.5 mm long, densely stellate-pubescent, divided to just above midway, lobes broadly acute; *petals* cream, narrowly obovate, 6-10 mm long, minutely stellate-pubescent toward the apex on the abaxial surface; *anthers* minutely stellate-pubescent. *Female flowers*: *calyx* as for males but smaller, 3.5-4.5 mm long (enlarging to c. 5 mm long in fruit); *petals* cream, shortly united with ovary near base, the free part c. oblong, stellate-pubescent near apex, exceeding calyx by c. 1-2 mm; *style-branches* stellate-pubescent along abaxial surface; ovary densely stellate-pubescent. Mature *mericarps* 5-6 mm long, c. 3 mm wide; *seeds* smooth, dark brown, 3-3.5 mm long, 1.5-2 mm diam., obliquely ovoid with a minutely incurved, uncinate tip, more or less trigonous in section. (Fig. 1)

PHENOLOGY

Flowering specimens have been collected in February, May, October, November and December. The flowers of one male specimen were described as 'chocolate-scented'. Fruiting specimens have been collected in December and February.

Fig. 1. The holotype of *Gynatrix macrophylla*.

ETYMOLOGY

The epithet (from Greek, meaning large-leaved) refers to the leaves that are typically larger than those of *G. pulchella*, the only other member of the genus.

DISTRIBUTION AND CONSERVATION STATUS

Apparently endemic in Victoria, where known from the catchments of the Howqua, Macalister, Avon, Mitchell, Tambo and Buchan Rivers in the Eastern Highlands, East Gippsland and Snowfields Natural Regions (Conn, 1993). From herbarium labels, populations of *G. macrophylla* are typically quite small (one plant to occasional in community). Although moderately widespread in eastern Victoria with a range exceeding 150 km, it appears to be poorly represented in conservation reserves, and is probably best regarded as rare, with Risk Code 3rci (Briggs & Leigh, 1989).

HABITAT

Apparently confined to riparian sites at altitudes between c. 100 and c. 1000 m, with associated species including *Eucalyptus viminalis, E. radiata, Acacia dealbata, A. melanoxylon, Pomaderris aspera, Brachychiton populneum, Bursaria spinosa* and *Hymenanthera dentata.*

NOTES

Gynatrix macrophylla differs from *G. pulchella* in having larger, relatively broader leaves (those of *G. pulchella* being 4-10(-15) cm long, 1.5-3(-6) cm wide), that are densely and evenly stellate-pubescent beneath and have more pronouncedly cordate bases and less attenuated apices. The flowers are up to twice as large in all features as those of *G. pulchella*, and the mature mericarps and seeds larger (those of *G. pulchella* being c. 3.5 and 2.5 mm long respectively). The seeds of *G. macrophylla* are also relatively more slender and have a small uncinate process at the apex.

While *G. pulchella* includes forms that vary from having leaves virtually glabrous to distinctly stellate-pubescent, the abaxial indumentum is (from specimens observed to date) neither as dense or as even as that of *G. macrophylla*. Distinctly pubescent forms of *G. pulchella* equate to *Plagianthus pulchellus* Willd. var. *tomentosa* Rodway (type from Tasmania, but extending through the range of the species), but this variety has not been maintained in contemporary works and no combination for it exists in *Gynatrix*.

SPECIMENS EXAMINED

VICTORIA: East Gippsland, Melick Munjie Creek, 15 Dec. 1970, *A.C. Beauglehole 35554* (MEL); Snowfields/Eastern Highlands, Carey River, 11 Nov. 1992, *E.A. Chesterfield 3471* (MEL); Eastern Highlands, Barkly River, 11 Nov. 1992, *E.A. Chesterfield 3473* (MEL); Gippsland, Murrindal River at the Pyramids, 1 Dec. 1990, *D.E. Albrecht 4618* (MEL); Central Gippsland, Freestone Creek, upstream of Culloden, 27 April 1992, *D.E. Albrecht 4966* (MEL); Beside the Wongungurra River, c. 7 km due east from Mt Murray, 19 Feb. 1985, *K.A. Menkhorst s.n.* (MEL, PERTH); Mitchell River, c. 20 miles (32 km) north-west of Bairnsdale, 18 July 1971, *D. Quinton* (MEL); Beside Tambo River, c. 1 km upstream from Collins Road Bridge, 18 km NNE from Bruthen, 12 Oct. 1988, *N.G. Walsh 2157* (BRI, HO, MEL); Buchan River, c. 0.5 km upstream of the township, 26 Jan. 1987, *D.E. Albrecht 3036* (MEL); Collector and locality unknown (MEL).

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Muelleria 9: 195–196 (1996)

Nomenclatural changes in *Cullen* (Fabaceae: Psoraleeae)

James W. Grimes

Harding Laboratory, New York Botanical Garden, Bronx, NY 10458, United States of America.

ABSTRACT
Several new combinations in *Cullen* Medik. (Fabaceae: Psoraleae) are made and six names in *Psoralea* are lectotypified.

Introduction

The following new combinations are made in advance of a revision of the genus *Cullen* Medik., in order to make the names available for the forthcoming Volume 3 of the *Flora of Victoria*. The opportunity is also taken to lectotypify six names in *Psoralea*.

New combinations and lectotypifications

Cullen australasicum (Schltdl.) J.W.Grimes, *comb. nov.*
Psoralea australasica Schltdl., *Linnaea* 20: 668, No. 197 [misprint for 196, see Lee, 1980] (1847). TYPE: '[South Australia], Ueberall bei Bethanien [Bethany, ca. 5 km NE of Adelaide], meist am Wasser.' HOLOTYPE: *H.H. Behr 196* (HAL 42501); ISOTYPE: MEL 89796.

Cullen cinereum (Lindl.) J.W.Grimes, *comb. nov.*
Psoralea cinerea Lindl. in T. Mitch., *Three Exped. Australia.* 2: 66 (1838). TYPE: Provenance unknown. HOLOTYPE: CGE (unavailable); ISOTYPE: [labelled May the 6, No. 122, Mitchell Journey, 1836], MEL 1563694.

Cullen discolor (Domin) J.W.Grimes, *comb. nov.*
Psoralea discolor Domin, *Bibliothec. Bot.* 20(89^3): 738 (1926). TYPE: 'Sudwest-Australien: Drummond 1850 No. 96, 1849, No. 158.' LECTOTYPE (**here designated**): *Drummond 96* (K); ISOLECTOTYPES: K, NSW, OXF, W.

Cullen microcephalum (Rchb. ex Kunze) J.W.Grimes, *comb. nov.*
Psoralea microcephala Rchb. ex Kunze, *Linnaea* 20: 72 (1847). TYPE: '...benevole communicata nobiscum est ab hort academ. Dresdensi.' LECTOTYPE (**here designated**): [labelled 'Psoralea microcephala Oct 1844'] W. *Psoralea adscendens* F.Muell., *Trans. Philos. Soc. Victoria* 1: 40 (1855). TYPE: 'On the grassy moist banks of the Snowy River, Gibbo River, Mitta Mitta, Owens River, and along torrents of the Australian Alps. LECTOTYPE (**here designated**): 'Mitta Mitta' (MEL 694217); ISOLECTOTYPES: K, MEL 694233, MELU 14423. *Psoralea gunnii* Hook.f., *Flora Tasman.* 1: 99 (1856). TYPE: 'Hab. Woolnorth, Gunn.' LECTOTYPE (**here designated**): *Gunn 1061* (K); ISOLECTOTYPE: K, NSW 30605.

Cullen pallidum (N.T.Burb.) J.W.Grimes, *comb. nov.*
Psoralea pallida N.T.Burb., *Telopea* 2: 127 (1980). TYPE: 'App. 22 miles south of Alice Springs, on railway line road, N.T. Burbidge & M. Gray 4379.' HOLOTYPE: CANB; ISOTYPE: NSW.

Cullen parvum (F.Muell.) J.W.Grimes, *comb. nov.*
Psoralea parva F.Muell., *Trans. Philos. Soc. Victoria* 1: 40 (1855). TYPE: 'In dry

pastures on the Thompson and Latrobe Rivers, and in South Australia, on the Torrens and Gawler Rivers, on the Barossa Ranges.' LECTOTYPE (**here designated**): 'Thompson River', Apr. 1854, *F. Mueller* (MEL 1563777); ISOLECTOTYPE: K.

Cullen patens (Lindl.) J.W.Grimes, *comb. nov.*
Psoralea patens Lindl. in T.Mitch., *Three Exped. Australia.* 2: 8 (1838). TYPE: provenance unknown. HOLOTYPE: CGE (unavailable, but seen by Lee, 1980); ISOTYPE: W. *Psoralea eriantha* Benth., ex T. Mitch., *J. Exped. Trop. Australia.* 131 (1848). TYPE: 'Sub-tropical New Holland, Ap.16-46, T.L. Mitchell 90.' LECTOTYPE: (**here designated**) K; ISOLECTOTYPE: NSW.

Cullen tenax (Lindl.) J.W.Grimes, *comb. nov.*
Psoralea tenax Lindl. in T.Mitch., *Three Exped. Australia.* 2: 9 (1838). TYPE: Provenance not recorded, but probably along the banks of the Darling. HOLOTYPE: CGE (not available).

Reference

Lee, A. (1980). The *Psoralea patens* complex. *Telopea* 2: 129-141.

Paper received 6 December, 1995

Muelleria 9: 197–228 (1996)

Chromosome number determinations in the Australian Astereae (Asteraceae)

K. Watanabe[1], P.S. Short[2], T. Denda[1], Y. Suzuki[3], M. Ito[3], T. Yahara[4] & K. Kosuge[1]

[1]Department of Biology, Faculty of Science, Kobe University, Kobe 657, Japan.
[2]National Herbarium of Victoria, Birdwood Avenue, South Yarra, 3141, Victoria, Australia.
[3]Department of Biology, Faculty of Science, Chiba University, Chiba, Japan.
[4]Department of Biology, Faculty of Science, Kyushu University, Hukuoka 812, Japan.

ABSTRACT

Chromosome number determinations from 200 populations attributed to 99 species or infraspecific taxa of ten genera are presented in Table I. They include the first substantiated reports for *Brachyscome glandulosa* (*2n* = 36), *B. muelleroides* (*n* = 3), *B. obovata* (*2n* = 18), *B. petrophila* (*2n* = 18), *B. tatei* (*n* = 9), *Erodiophyllum elderi* (*2n* = 16), *Minuria gardneri* (*n* = 9), *M. integerrima* (*n* = 18), *Olearia astrotricha* (*n* = 9), *O. ferresii* (*n* = 9), *O. imbricata* (*n* = 9), *O. plucheacea* (*n* = 9), *O. ramulosa* (*n* = 9), *O. xerophila* (*n* = 9), *Vittadinia cuneata* (*n* = 9), *V. gracilis* (*n* = 9), *V. muelleri* (*n* = 9), *V. pterochaeta* (*n* = 9), *V. pustulata* (*n* = 9) and *V. sulcata* (*n* = 9). Polyploidy is reported for the first time in *Brachyscome dissectifolia*, *B. cardiocarpa*, *Calotis anthemoides* and in the *Olearia phlogopappa* complex. Remaining counts support previously reported determinations and add to the knowledge of chromosome number distribution within taxa. Some taxonomic problems are briefly discussed. It is concluded that chromosomal variation in Australian Astereae is similar to that found in North America.

Introduction

In a recent census of Australian vascular plants 831 native species of Asteraceae were listed under *c.* 130 genera (Hnatiuk 1990). About 330 formally recognised species belong to the tribe Astereae, and most are currently distributed amongst four genera, i.e. *Olearia* Moench (*c.* 130), *Brachyscome* Cass. (*c.* 70), *Vittadinia* A.Rich. (29) and *Calotis* R.Br. (*c.* 28). The remaining genera here considered to belong to the Astereae are *Achnophora* F.Muell. (1), *Camptacra* N.T.Burb (2), *Celmisia* Cass. (*c.* 10), *Centipeda* Lour. (5), *Ceratogyne* Turcz. (1), *Dichrocephala* DC. (1), *Dichromochlamys* Dunlop (1), *Dimorphocoma* F.Muell. & Tate (1), *Elachanthus* F.Muell. (2), *Erigeron* L. (*c.* 10), *Erodiophyllum* F.Muell. (2), *Eurybiopsis* DC. (1), *Isoetopsis* Turcz. (1), *Ixiochlamys* F.Muell. & Sond. (4), *Kippistia* F.Muell. (1), *Minuria* DC. (10 or 11), *Lagenifera* Cass. (4) and *Solenogyne* Cass. (3).

Chromosome number surveys have been primarily restricted to just two genera, i.e. *Brachyscome* (Smith-White *et al.* 1970, Carter 1978, Watanabe & Short 1992) and *Calotis* (Stace 1978, 1982). In this paper we report further chromosome number determinations for both of these genera as well as new determinations for native species of *Erodiophyllum*, *Lagenifera*, *Minuria*, *Olearia*, *Solenogyne* and *Vittadinia*, briefly examine previous reports, and comment on some associated taxonomic problems.

A number of species of Astereae belonging to *Aster* L., *Bellis* L., *Conyza* Less., *Erigeron* L. and *Solidago* L. are naturalised in Australia but with the exception of *Erigeron karvinskianus* they have not been examined.

Materials and methods

Chromosome counts were obtained from either floral bud material fixed in the field, or from root tips obtained from seedlings grown from fruit of known provenance. For the

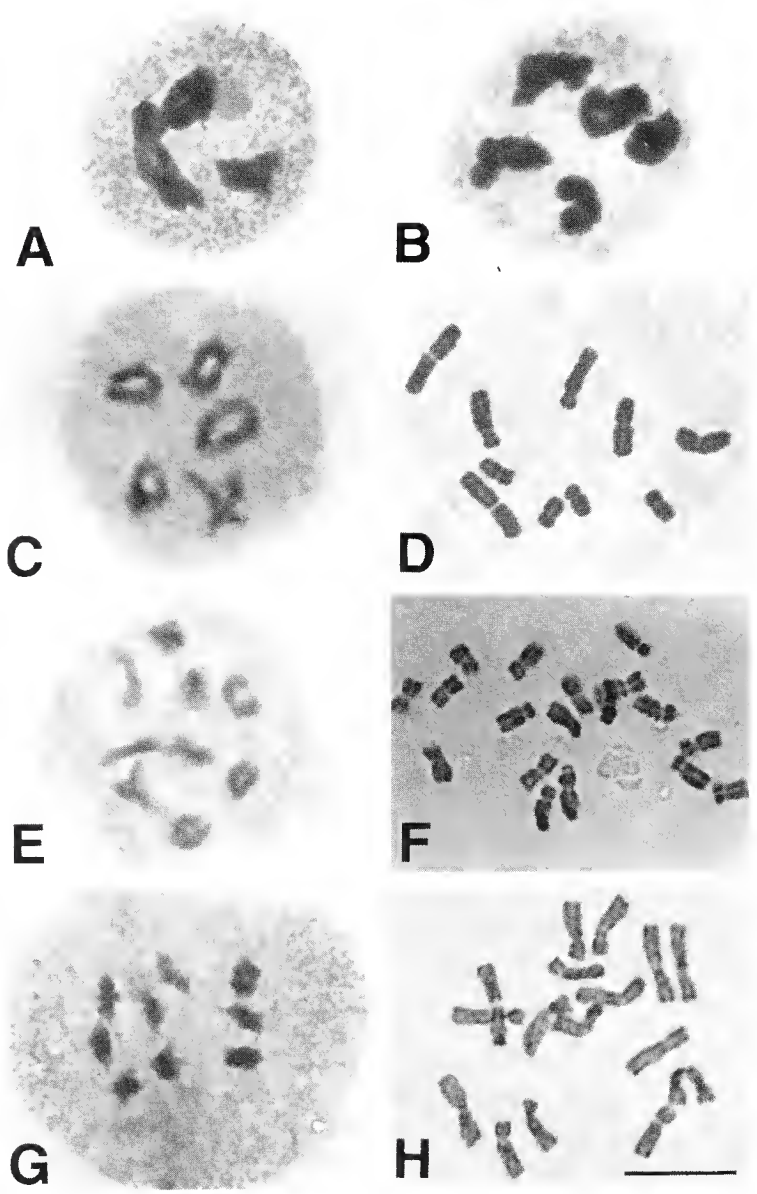

Fig. 1. Mitotic and meiotic chromosomes in Australian Astereae. A - *Brachyscome muellerioides* $n = 3$II (*Watanabe 3*). B - *B. readeri* $n = 5$II (*Watanabe 4*). C - *B.* sp. aff. *nova-anglica* $n = 5$II (*Short 3969*). D - *B.* sp. aff. *angustifolia* $2n = 10$ (*Short 3979*). E - *B. tatei* $n = 9$II (*Watanabe 184*). F - *Minuria leptophylla* $2n = 18$ (*Watanabe 194*). G - *Vittadinia gracilis* $n = 9$II (*Short 3925*). H - *Erodiophyllum elderi* $2n = 16$ (*Short 3779*). Scale: 10 μm.

cultivation of specimens and the preparation of material for chromosome number determinations the procedures of Smith-White *et al.* (1970) and Watanabe *et al.* (1975) were followed. Herbarium vouchers have been gathered for all but two species (*Brachyscome petrophila* and *Olearia ramulosa*) and a complete set of vouchers is housed at MEL. An incomplete set will be deposited in TI and voucher specimens of non-Victorian populations will be deposited in the major government herbarium (AD, BRI, NSW, PERTH) of the State from which collections were gathered.

Results

Chromosome number determinations from 200 populations attributed to 99 species or infraspecific taxa of ten genera are presented in Table I. They include the first substantiated reports for *Brachyscome glandulosa* ($2n = 36$), *B. muelleroides* ($n = 3$), *B. obovata* ($2n = 18$), *B. petrophila* ($2n = 18$), *B. tatei* ($n = 9$), *Erodiophyllum elderi* ($2n = 16$), *Minuria gardneri* ($n = 9$), *M. integerrima* ($n = 18$), *Olearia astrotricha* ($n = 9$), *O. ferresii* ($n = 9$), *O. imbricata* ($n = 9$), *O. phlogopappa* ($n = 9$), *O. ramulosa* ($n = 9$), *O. xerophila* ($n = 9$), *Vittadinia cuneata* ($n = 9$), *V. gracilis* ($n = 9$), *V. muelleri* ($n = 9$), *V. pterochaeta* ($n = 9$), *V. pustulata* ($n = 9$) and *V. sulcata* ($n = 9$). Some reports for apparently distinct, but undescribed, taxa such as *Calotis* aff. *lappulacea* ($n = 8$) and *B. tenuiscapa* aff. var. *tenuiscapa* ($2n = 28$) are also presented, as are new determinations for some previously examined taxa, e.g. *Brachyscome microcarpa* ($n = 6$, $2n = 12$; cf. $n = 10$ reported by Smith-White *et al.* 1970). Polyploidy is reported for the first time in *Brachyscome dissectifolia*, *B. cardiocarpa, Calotis anthemoides* and in the *Olearia phlogopappa* complex and B chromosomes are newly reported in *Brachyscome ciliocarpa*, *B. diversifolia*, *B. iberidifolia*, *B. trachycarpa*, *Minuria leptophylla* and *Olearia pimelioides*.

The meiotic or mitotic chromosomes of some species are displayed in Fig. 1.

The new data is incorporated (by reference to Watanabe *et al.* 1996) in Table II which summarises known chromosome numbers for taxa of Australian Astereae.

Discussion

As previously pointed out (Watanabe & Short 1992) there are many taxonomic problems within *Brachyscome*. There are unresolved species complexes, e.g. *B. nova-anglica* and its allies and the *B. ciliaris* complex, and generic delimitation is also a problem. The same is true for many of the other genera and the placement of *Isoetopsis* in the Astereae is debatable and perhaps not tenable (Bremer & Anderberg in Bremer 1987, Bruhl & Quinn 1990, Bremer & Humphries 1993). Although there are taxonomic problems it is none the less possible to generally review the state of knowledge of chromosome numbers in the Australian Astereae. An absence of chromosome numbers for some genera, i.e. *Achnophora*, *Camptacra*, *Dichrocephala*, *Dichromochlamys*, *Dimorphocoma* and *Elachanthus* is unfortunate, although between them these genera contain only 12 Australian species.

TABLE 1. NEW CHROMOSOME NUMBER DETERMINATIONS FOR AUSTRALIAN ASTEREAE

Species & locality	n	2n
Brachyscome Cass.		
B. aculeata (Labill.) Less.		
5.5 km SE of Sawyers Hill, Kosciusko N.P., N.S.W., 3 Feb. 1993, *Short 3982*	9II	
Sawpit Creek, Kosciusko N.P., N.S.W., 4 Feb. 1993, *Short 3996*	9II	

TABLE 1. CONTINUED

Species & locality	n	2n
6 km from Cathcart toward Rocky Hall, 9 Feb. 1993, N.S.W., *Short 4010*	9II	
Bundara R. crossing on Omeo to Tallangatta road, Vict., 9 Feb. 1993, *Short 4018*	18II + 2Bs	
B. sp. aff. ***augustifolia*** A. Cunn. ex DC. Mt Kaputar N.P., N.S.W., 28 Jan. 1993, *Short 3944*	5II	10
Stewart Forest, Barrington Tops State Forest, N.S.W., 1 Feb. 1993, *Short 3979*	5II	10
Polblue Picnic Site, Barrington Tops State Forest, N.S.W., 1 Feb. 1993, *Short 3981*		10
B. basaltica F.Muell. var. ***basaltica*** 4 km NE of Millmerran, Qld, 29 Sept. 1992, *Watanabe 25*	8II	16
var. ***gracilis*** Benth. 14 km N of Booligal, N.S.W., 6 Sept. 1992, *Watanabe 76*		12
Barmah State Park, Vict., 23 Sept. 1992, *Watanabe 1*	6II	
20 km N of Apsley, Vict., 25 Oct. 1993, *Watanabe 222*	6II	
B. cardiocarpa F.Muell. ex Benth. Digby to Strathdownie road, Vict., 3 Sept. 1990, *Short 3919*		36
19 km NW of Apsley, Vict., 12 Oct. 1995, *Watanabe 306*		36
B. cheilocarpa F.Muell. 94 km N of Galena Bridge on NW Coastal Hwy, W.A., 6 Oct. 1993, *Short 4083*		18
1 km W of NW Coastal Hwy along road to Blowholes, W.A., 7 Oct. 1993, *Short 4097*		18
B. aff. ***cheilocarpa (A)*** Pt Quobba, W.A., 7 Oct. 1993, *Short 4091*		18

TABLE 1. CONTINUED

Species & locality	n	2n
B. aff. ***cheilocarpa (B)***		
Cleary to Paynes Find road, W.A., 17 Sept. 1990, *Short 3823*	9II	
Yalgoo, W.A., 10 Oct. 1993, *Short 4108*	9II	
B. ciliaris (Labill.) Less. complex		
Cape Riche, W.A., 14 Oct. 1993, *Short 4126*	9II	
Tooreburrup Scenic Lookout, W.A., 14 Oct. 1993, *Watanabe 173*	9II	
35 km E of Jerramungup, Fitzgerald River Crossing, W.A., 15 Oct. 1993, *Watanabe 174*	9II	
6 km W of Coolgardie, W.A., 2 Oct. 1993, *Watanabe 107*		27
4 km NE of Millmerran, Qld, 29 Sept. 1992, *Watanabe 27*		27
52 km SW of Louth, N.S.W., 2 Oct. 1992, *Watanabe 47*		27
13 km N of Carnamah, W.A., 5 Oct. 1993, *Short 4075*		36
33 km from Blowholes along road to Carnarvon, W.A., 7 Oct. 1993, *Short 4094*		36
5 km E of Pindar, W.A., 9 Oct. 1993, *Short 4105*		36
27 km from Great Northern Hwy along road to Warriedar Hmsd, W.A., 10 Oct. 1993, *Short 4116*		36
63 km W of Balladonia, W.A., 1 Oct. 1993, *Watanabe 103*		36
6 km W of Coolgardie, W.A., 2 Oct. 1993, *Watanabe 106*		36
12.5 km W of Coolgardie, W.A., 2 Oct. 1993, *Watanabe 110*		36
Bonnie Rock, W.A., 11 Oct. 1993, *Watanabe 158*		36
E edge of Lake Wallambin, W.A., 11 Oct. 1993, *Watanabe 163*		36

TABLE 1. CONTINUED

Species & locality	n	2n
25 km NW of Pt Augusta, S.A., 29 Sept. 1993, *Watanabe 101*		36
61 km N of Hawker, S.A., 20 Oct. 1993, *Watanabe 191*		36
10 km NNE of Ashford, N.S.W., 26 Sept. 1992, *Watanabe 15*		36
B. ciliocarpa W. Fitzg.		
'The Loop', Murchison River, Kalbarri N.P., W.A., 6 Oct. 1993, *Short 4080*		18 + 2Bs
40 km from Yalgoo, W.A., 9 Oct. 1993, *Short 4107*	9II	
30 km from Paynes Find along road to Cleary, W.A., 10 Oct. 1993, *Short 4119*		18
B. sp. aff. ***ciliocarpa***		
41 km E of Quilpie, Qld, 17 Aug. 1989, *Short 3607*	9II	
B. curvicarpa G.L.R.Davis		
59.5 km SW of Bourke, N.S.W., 2 Oct. 1992, *Watanabe 41*	4II + BI	
0.9 km SW of Louth, N.S.W., 2 Oct. 1992, *Watanabe 43*	4II + BI	
B. debilis Sond.		
Mt Arapiles, Vict., 25 Oct. 1993, *Watanabe 217*	3II	6
B. decipiens Hook.f.		
Sawyers Hill, Kosciusko N.P. N.S.W., 3 Feb. 1993, *Short 3986*	9II	18
B. dentata Gaudich.		
Dalby, N.S.W., 30 Sept. 1992, *Watanabe 29*	4II or 4II + BI	
44 km SW of Louth, N.S.W., 2 Oct. 1992, *Watanabe 46*	4II	
24 km NE of Wirrealpa, N.S.W., 3 Oct. 1992, *Watanabe 55*	4II	
80 km SE of Broken Hill, N.S.W., 6 Oct. 1992, *Watanabe 70*	4II + BI	
48 km SE of Martins Well, N.S.W., 3 Oct. 1992, *Watanabe 53*	8II	

TABLE 1. CONTINUED

Species & locality	n	2n
27 km S of Tilpa, N.S.W., 2 Oct. 1992, *Watanabe 52*	12II	
c. 45 km SE of Broken Hill, N.S.W., 6 Oct. 1992, *Watanabe 67*	12II	
33 km SW of Broken Hill, N.S.W., 22 Oct. 1993, *Watanabe 201*	12II	
c. 43 km SE of Broken Hill, N.S.W., 22 Oct. 1993, *Watanabe 203*	12II	
20 km E of Elmore, Vict., 7 Oct. 1992, *Watanabe 77*	12II	
B. dissectifolia G.L.R.Davis		
3.5 km NW of Backwater, N.S.W., 30 Jan. 1993, *Short 3973*	12II	24
B. diversifolia (Hook.) Fischer & Meyer		
17 km SE of Halls Gap, Vict., 27 Sept. 1993, *Watanabe 95*	12II	
Polblue Creek, Barrington Tops State Forests, N.S.W., 1 Feb. 1993, *Short 3981*	18II	36 + 0-1B
B. exilis Sond.		
Mullett Lake Nature Reserve, near Esperance, W.A., 16 Oct. 1993, *Watanabe 178*	9II	18
B. formosa P.S.Short		
1.6 km SE of Coonabarabran, N.S.W., 24 Sept. 1992, *Watanabe 6*	9II	
B. glandulosa (Steetz) Benth.		
Boyagin Rock, W.A., 12 Oct. 1993, *Watanabe 165*		36
B. gracilis G.L.R. Davis		
7.5 km towards Ashford from Bonshaw to Glen Innes road, N.S.W., 29 Jan. 1993, *Short 3962*		18
B. graminea (Labill.) F.Muell.		
Sawpit Creek, Kosciusko N.P. N.S.W., 6 Feb. 1993, *Short 4008*	9II	
Green Cape Lighthouse, N.S.W. 7 Feb. 1993, *Short 4015*	9II	18
B. halophila P.S.Short		
13 km N of Carnamah, W.A., 5 Oct. 1993, *Short 4072*	9II	

TABLE 1. CONTINUED

Species & locality	n	2n
11 km W of Pindar, W.A., 9 Oct. 1993, *Short 4101*	9II	
B. iberidifolia Benth. complex		
Moora, W.A., 4 Oct. 1993, *Short 4065*	9II	
13 km N of Carnamah, W.A., 5 Oct. 1993, *Short 4074*		18
2.5 km S of Binnu, W.A., 5 Oct. 1993, *Short 4077*	9II	
21 km from Carnarvon along road to Gascoyne Junction, W.A., 7 Oct. 1993, *Short 4087*		18
29 km N of Galena Bridge, W.A., 8 Oct. 1993, *Short 4100*	9II	
Cosy Corner, W.A., 13 Oct. 1993, *Short 4124*	9II	
Mt Chudalup, W.A., 13 Oct. 1993, *Short 4125*	9II or 9II + BI	
9 km N of Nallan Homestead turn-off along Great Northern Highway, W.A., 26 Aug. 1995, *Short 4227*	9II	
Cape Leeuwin, W.A., 3 Nov. 1995, *Short 4550*	9II	
74 km WSW of Coolgardie, W.A., 2 Oct. 1993, *Watanabe 111*	9II	
Yellowdine, W.A., 2 Oct. 1993, *Watanabe 113*		9II
c. 5 km NW of Bonnie Rock, W.A., 11 Oct. 1993, *Watanabe 161*	9II	
Lake Wallanbin, W.A., 11 Oct. 1993, *Watanabe 164*	9II	
35 km E of Jerramungup, Fitzgerald River crossing, W.A., 15 Oct. 1993, *Watanabe 175*	9II	
B. latisquamea F. Muell.		
Pt Quobba, W.A., 7 Oct. 1993, *Short 4090*		18

TABLE 1. CONTINUED

Species & locality	n	2n
33 km from Blowholes along road to Carnarvon, W.A., 7 Oct. 1993, *Short 4093*		18
B. lineariloba (DC.) Druce S of Border Village on S.A./W.A. border, 29 Sept. 1993, *Watanabe 102*		12
12.5 km W of Kimba, S.A., 19 Oct. 1993, *Watanabe 187*		12
6 km W of Coolgardie, W.A., 2 Oct. 1993, *Watanabe 105*		16
7 km S of Bimbijy Hmsd turn-off along Paynes Find to Cleary Road, W.A., 10 Oct. 1993, *Short 4122*		16
33 km from Broken Hill on Menindee road, N.S.W., 22 Oct. 1993, *Watanabe 200*		16
B. melanocarpa Sond. & F.Muell 1.4 km W of Menindee, N.S.W., 22 Oct. 1993, *Watanabe 209*	12II	
B. microcarpa F.Muell. Girraween N.P., Qld, 29 Jan. 1992, *Watanabe 80*	6II	12
6 km S of Boonoo Boonoo, N.S.W., 30 Jan. 1993, *Short 3970*	6II	
B. muelleroides G.L.R.Davis Ulupna Island, Vict., 23 Sept. 1992, *Watanabe 3*	3II	
B. aff. ***multicaulis*** F.Muell. 8 km W of Kiandra, N.S.W., 3 Feb. 1993, *Short 3988*	9II	18 + 0-2Bs
B. multifida DC. complex 3 km S of Glen Alpin, Qld, 30 Jan. 1993, *Short 3965*	7II	
Warrumbungles N.P., N.S.W., 25 Sept. 1992, *Watanabe 7*	7II	
Mt Kaputar N.P., N.S.W., 25 Sept. 1992, *Watanabe 11*	7II	14
Nr Clover Flat along Big River Fire Track, Vict., 9 Feb. 1993, *Short 4021*	9II	18

TABLE 1. CONTINUED

Species & locality	n	2n
1.2 km NW of MacKenzie Falls, Vict., 27 Sept. 1993, *Watanabe 97*	9II	
B. nivalis F.Muell. Club Lake, Mt Kosciusko N.P., N.S.W., 5 Feb. 1993, *Short 4005*	11II	22
B. nodosa P.S.Short & K.Watan. Bracket Creek, Qld, 29 Sept. 1992, *Watanabe 19*	3II	
15.5 km E of Inglewood, Qld, 29 Sept. 1992, *Watanabe 20*	3II	
2 km E of Inglewood, Qld, 29 Sept. 1992, *Watanabe 24*	3II	
69 km N of Coonabarabran, N.S.W., 25 Sept. 1992, *Watanabe 8*	3II	
B. nova-anglica G.L.R.Davis Girrawcen N.P., Qld, 29 Jan. 1993, *Watanabe 79*	7II	14
26.5 km SE of Wongwibinda, N.S.W., 31 Jan. 1993, *Short 3978*	7II	14
B. aff. ***nova-anglica (A)*** 3 km S of Glen Aplin, Qld, 30 Jan. 1993, *Short 3969*	5II	10
B. aff. ***nova-anglica (B)*** Mt Kaputar N.P., N.S.W., 25 Sept. 1992, *Watanabe 9*	6II	12
B. obovata G.L.R.Davis Daners Gap, Mt Koskiusko N.P. N.S.W., 4 Feb. 1993, *Short 3993*		18
Blue Lake to Charlotte Pass Mt Koseiusko N.P., N.S.W., 5 Feb. 1993, *Short 3997*		18
Mustering Flat, Baw Baw Plateau, Vict., 26 Feb. 1991, *Walsh 3051*		18
B. oncocarpa Diels 100 km N of Galena Bridge on NW Coastal Hwy, W.A., 6 Oct. 1993, *Short 4084*		18

TABLE 1. CONTINUED

Species & locality	n	2n
B. papillosa G.L.R.Davis		
28.7 km S of Ivanhoe, N.S.W., 6 Oct. 1992, *Watanabe 73*	4II or 4II + 1B	
Muggabah Creek, 14 km N of Booligal, N.S.W., 6 Oct. 1992, *Watanabe 75*		8
B. perpusilla (Steetz) J.M.Black		
Totadgin Rock, W.A., 3 Oct. 1993, *Watanabe 115*		18
Bonnie Rock, W.A., 11 Oct. 1993, *Watanabe 160*		18
B. petrophila G.L.R.Davis		
Angler's Rest, Vict. Unvouchered colln, Feb. 1993		18
B. procumbens G.L.R.Davis		
Mt Kaputar N.P., N.S.W., 28 Jan. 1993, *Short 3951*		18
B. ptychocarpa F.Muell.		
Mt Mittamatite Regional Park, Vict., 3 Dec. 1993, *Short 4151*	6II	12
B. pusilla Steetz		
W edge of Lake King, W.A., 1 Nov. 1995, *Short 4533*	9II	
B. radicans Steetz ex Lehm.		
Mother of Ducks Nature Reserve, Guyra, N.S.W., 31 Jan. 1993, *Short 3976*	13II	26
B. readeri G.L.R.Davis		
Ulupna Island, Vict., 23 Sept. 1992, *Watanabe 4*	5II	10
B. rigidula (DC.) G.L.R.Davis		
Lake Omeo, *c.* 0.4 km S of intersection of Blowhard road and Lake Omeo road, Vict., 9 Feb. 1993, *Short 4016*	9II	18
B. scapigera (Sieber ex Sprengel) DC.		
3.5 km NW of Backwater, N.S.W., 30 Jan. 1993, *Short 3972*	9II	18
Buckety Plains, Bogong N.P., Vict., 9 Feb. 1993, *Short 4023*	9II	
B. smithwhitei P.S.Short & K.Watan.		
28.7 km S of Ivanhoe, N.S.W., 6 Oct. 1992, *Watanabe 72*	6II or 3IV	

TABLE 1. CONTINUED

Species & locality	n	2n
1.4 km W of Menindee, N.S.W., 22 Oct. 1993, *Watanabe 210*	6II or 3IV	
B. spathulata Gaudich.		
Sawyers Hill, Kosciusko N.P., N.S.W., 3 Feb. 1993, *Short 3985*	27II	
Daners Gap, Kosciusko N.P., N.S.W., 4 Feb. 1993, *Short 3994*	27II	
Club Lake, Kosciusko N.P., N.S.W., 5 Feb. 1993, *Short 4003*	9II	18
Cathcart to Rocky Hall, N.S.W., 6 Feb. 1993, *Short 4011*	27II	
B. stolonifera G.L.R.Davis		
Club Lake, Kosciusko N.P., N.S.W., 5 Feb. 1993, *Short 4006*	15II	30
B. stuartii Benth.		
Girraween N.P., Qld, 29 Jan. 1993, *Watanabe 81*	6II	12
11 km from Deepwater towards Tenterfield, N.S.W., 29 Jan. 1993, *Short 3964*	6II	
B. tatei J.M.Black		
42.5 km E of Border Village, S.A., 18 Oct. 1993, *Watanabe 184*	9II	18
B. tenuiscapa Hook.f.		
var. ***pubescens*** (Benth.) G.L.R.Davis		
3.5 km NW of Backwater, N.S.W., 30 Jan. 1993, *Short 3975*	9II	
aff. var. ***tenuiscapa***		
3.5 km NE of Mt Reynard, Snowy Plains, Viet., *Walsh s.n.*, Cultivated RBG, Accession No. 905484		28
B. trachycarpa F.Muell.		
Ceduna, S.A., 12 Sept. 1990, *Short 3781*	18 + 0-2Bs	
B. sp. aff. ***trachycarpa*** F.Muell.		
25 km W of Dalby, N.S.W., 30 Sept. 1992, *Watanabe 31*	27I or 1III + 0-9II + Is	
Brachyscome *sp.*		
8 km NW of Glendambo, S.A., 26 Aug. 1989, *Short 3673*	9II	

TABLE 1. CONTINUED

Species & locality	n	2n
119 km N of Glendambo, S.A., 26 Aug. 1989, *Short 3682*	9II	
Calotis R.Br.		
C. anthemoides F.Muell. Ulupna Is., Vict. 26 Sept. 1993, *Watanabe 92*	14II	
C. cuneata (F.Muell. ex Benth.) G.L.R.Davis var. ***cuneata*** 25 km W of Dalby, N.S.W., 30 Sept. 1992, *Watanabe 32*	16II	
C. cuneifolia R.Br. 17 km SW of Dubbo, N.S.W. 24 Sept. 1992, *Watanabe 5*	8II	16
15.5 km E of Inglewood, Qld, 29 Sept. 1992, *Watanabe 23*	8II	
20 km E of Elmore, Vict., 7 Oct. 1992, *Watanabe 78*	8II	
25 km W of Dalby, N.S.W., 30 Sept. 1992, *Watanabe 34*	16II	
C. cymbacantha F.Muell. Tilpa, N.S.W., 2 Oct. 1992, *Watanabe 48*	14II	
C. dentex R.Br. 3 km S of Glen Alpin, Qld, 30 Jan. 1993, *Short 3967*	8II	16
C. erinacea Steetz 15 km SW of Kimba, S.A., 21 Sept. 1982, *Short 1766*	12II + 1IV	
C. lappulacea Benth. 15.5 km E of Inglewood, Qld, 29 Sept. 1992, *Watanabe 21*	14II	
C. aff. ***lappulacea*** 15.5 km E of Inglewood, Qld, 29 Sept. 1992, *Watanabe 22*	8II	
C. multicaulis (Turez.) Druce 38 km N of Pt Augusta, S.A., 5 Oct. 1992, *Watanabe 62*	4II	
C. plumulifera F.Muell. 24 km NE of Wirrealpa, S.A., 4 Oct. 1992, *Watanabe 56*	5II + BII	

TABLE 1. CONTINUED

Species & locality	n	2n
72 km S of Charleville, Qld, 1 Oct. 1992, *Watanabe 38*		5II + BII
45 km SE of Broken Hill, N.S.W., 6 Oct. 1992, *Watanabe 66*	5II + 2BI	
80 km SW of Broken Hill, N.S.W., 6 Oct. 1992, *Watanabe 69*		5II + 2BI
C. scabiosifolia Sond. & F.Muell var. ***scabiosifolia*** 15 km SW of Louth, N.S.W., 2 Oct. 1992, *Watanabe 45*	8II	
28.7 km S of Ivanhoe, N.S.W., 23 Oct. 1993, *Watanabe 213*	8II	
Sawpit Creek, Kosciusko N.P., N.S.W., 4 Feb. 1993, *Short 3995*	16II	
C. scapigera Hook. Louth, N.S.W., 2 Oct. 1992, *Watanabe 42*	8II	
6 km NE of Jerilderie, N.S.W., 26 Jan. 1993, *Short 3933*	16II	
Erigeron L. ***E. karvinskianus*** DC. 4 km N of Mt Slide, Vict., March 1991, *H.Manson s.n.*, (MEL 1592608)		36
Erodiophyllum F.Muell. ***E. elderi*** F.Muell. 41 Km ENE of Iron Knob, S.A., 12 Oct. 1990, *Short 3779*		16
Kippistia F.Muell. ***K. suaedifolia*** F.Muell. Lake Austin, W.A., 25 Aug. 1995, *Short 4221*	9II	
Lagenifera Cass. ***L. huegellii*** Benth. 4 km N of Zumstein, Grampians, Vict., 26 Oct. 1993, *Watanabe 225*		18
L. stipitata (Labill.) Druce Mt Kaputar N.P., N.S.W. 28 Jan. 1993 *Short 3952*	9II	18
Barington Tops State Forests, N.S.W., 1 Feb. 1993, *Short 3980*		18

TABLE 1. CONTINUED

Species & locality	n	2n
Minuria DC.		
M. cunninghamii (DC.) Benth.		
Lake Austin, W.A., 25 Aug. 1995 *Short 4223*	9II	
Tilpa, N.S.W., 2 Oct. 1992 *Watanabe 49*	9II	
M. gardneri Lander & R.Barry		
Lake Austin, W.A., 25 Aug. 1995, *Short 4222*	9II	
M. integerrima (DC.) Benth.		
Dalby, N.S.W., 30 Sept. 1992, *Watanabe 30*	18II	
28 km W of Condamine, N.S.W., 30 Sept. 1992, *Watanabe 35*	18II	
0.9 km SW of Louth, N.S.W. 2 Oct. 1992, *Watanabe 44*	18II	
M. leptophylla DC.		
Wudinna Hill, S.A., 19 Oct. 1993, *Watanabe 186*	9II	
28.5 km N of Orroroo, S.A., 21 Oct. 1993, *Watanabe 194*	9II	18 + 0-2Bs
Olearia Moench		
O. astrotricha (F.Muell.) F.Muell. ex Benth.		
Victoria Range road, Grampians, Vict., 2 Dec. 1986, *Corrick 10103*	9II	
O. ciliata (Benth.) F.Muell. ex Benth.		
10 km SE of Ravensthorpe, W.A., 3 Sept. 1986, *Short 2663*	9II	
Between Karkoo and Mount Hill, S.A., 29 Sept. 1993, *Watanabe 100*	9II	
O. ferresii (F.Muell.) F.Muell. ex Benth.		
S. boundary of Ormiston Gorge N.P., N.T., 12 Aug. 1988, *Short 3148*	9II	
O. humilis Lander		
Sandstone to Yuinmery, W.A., 14 Oct. 1986, *Short 2563*	9II	
Yuinmery, W.A., 14 Oct. 1986, *Short 2565*	9II	

TABLE 1. CONTINUED

Species & locality	n	2n
O. imbricata (Turcz.) Benth. 10 km SE of Ravensthorpe, W.A., 3 Sept. 1986, *Short 2662*	9II	
O. phlogopappa (Labill.) DC. complex Falls Creek, Vict., 2 March 1987 *Short 3035*	18II	
O. pinifolioides (DC.) Benth. 53.5 km E of 'Nallan', W.A., 1986, *Lander 1391*	9II	
Sandstone-Paynes Find road, W.A., 24 Aug. 1986, *Short 2564*	9II	
Parachilna to Blinman road, S.A., 20 Oct. 1993, *Watanabe 193*		18 + 2Bs
O. plucheacea Lander Kennedy Range, W.A., 20 Aug. 1986, *Short 2535*	9II	
O. ramulosa (Labill.) Benth. complex Golton Gorge, Grampians, Vict. 11 Sept. 1986, *RBG 86/1735*	9II	
O. rudis (Benth.) Benth. 19 km SW of Three Springs, W.A., 9 Sept. 1986, *Short 2795*	9II	
10 km S of Mt Hope, N.S.W., 16 Sept. 1987, *Short 3078*	9II	
17 km N of Patchewollock, Vict., 25 Aug. 1988, *Short 3174*	9II	
O. stuartii (F.Muell.) Benth. Kennedy Range, W.A., 20 Aug. 1986 *Short 2538*	9II	
O. xerophila (F.Muell.) Benth. Dales Gorge, W.A., 30 Aug. 1995, *Short 4275*	9II	
Olearia sp. 23.6 km N of Maroubra Rd/Scotsman Rd intersection, W.A., 1986, *Lander 1408*	9II	
Solenogyne Cass. ***S. dominii*** L.G.Adams Ulupna Island, Vict., 25 Jan. 1993, *Short 3923*		18

TABLE 1. CONTINUED

Species & locality	n	2n
Vittadinia A.Rich.		
V. cuneata DC.		
var. ***hirsuta*** N.T.Burb.		
4 km NE of Milmerran, Qld, 29 Sept. 1992, *Watanabe 26*	9II	18
V. gracilis (Hook.f.) N.T.Burb.		
2 km W of Hines Hill, W.A., 23 Oct. 1995, *Short 4450*	9II	
Ulupna Island, Vict., 25 Jan. 1993, *Short 3925*	9II	
V. muelleri N.T.Burb.		
44 km NE of Narrabri, N.S.W., 26 Sept. 1992, *Watanabe 14*	9II	
V. pterochaeta (F.Muell. ex Benth.) J.M.Black		
24 km NE of Wirrealpa, S.A., 3 Oct. 1992, *Watanabe 57*	9II	
V. pustulata N.T.Burb.		
28 km W of Condamine, N.S.W., 30 Sept. 1992, *Watanabe 36*	9II	
V. sulcata N.T.Burb.		
c. 10 km S. of Wild Dog Glen, S.A., 20 Oct. 1993, *Watanabe 190*	9II	

BRACHYSCOME

As in Watanabe & Short (1992) our references to species and species complexes in Tables I & II are largely the concepts of Davis (1948, 1949, 1955, 1959) and Smith-White *et al.* (1970) although the concept of 'superspecies' is not used. As we are primarily concerned here with the presentation of new chromosome number determinations and with reviewing chromosome numbers in the Australian Astereae, further comments on species or generic delimitation are here kept to a minimum. Such problems will be the subject of future papers and will follow after the completion of detailed anatomical, morphological, cytological and macromolecular studies.

As currently recognised *Brachyscome* is a genus of more than 80 species and occurs in Australia, New Guinea and New Zealand. Of these, over 70 species are confined to Australia. Davis (1948) recognised two subgenera within *Brachyscome*, i.e. '*Eubrachyscome*' and '*Metabrachyscome*'. They are illegitimate names but are frequently adopted in cytological papers (e.g. Smith-White *et al.* 1970).

The majority of species were referred by Davis to 'subgenus *Eubrachyscome*' and this group was the subject of cytological investigations by Smith-White *et al.* (1970). They found an array of chromosome numbers in the group and suggested that it represents a reducing series, i.e. $x = 9$ to $x = 2$. It was also noted that most species with $n = 9$ (including polyploids) are mesic, perennial species. In contrast, species of arid regions frequently display an annual habit and this is correlated with lower chromosome numbers. Chromosome number determinations by Watanabe & Short (1992), and in this paper for species not examined by Smith-White *et al.*, are consistent with these observations. Thus *B. goniocarpa* ($n = 4$), *B. gracilis* ($n = 4$), *B. muelleri* ($n = 3$) and *B. muelleroides* ($n = 3$) are all annual species which occur in arid, or seasonally dry areas.

As noted by Carter (1978a), species referred by Davis to 'subgenus *Metabrachyscome*' are chromosomally conservative compared to members of '*Eubrachyscome*'. All species have $x = 9$, with polyploidy mainly confined to the *B. ciliaris* complex. Many of the species are also annuals confined to arid regions.

The *B. iberidifolia* complex referred to in both Tables is mainly confined to Western Australia and includes *B. bellidioides* and *B. pusilla*. The complex belongs to 'subgenus *Metabrachyscome*'. There is considerable diversity in collections referred by us to this complex and additional taxa undoubtedly should be recognised.

The chromosome complements of *B. nivalis* ($2n = 22$), *B. radicans* ($2n = 26$), *B. tenuiscapa* aff. var. *tenuiscapa* ($2n = 28$) and *B. stolonifera* ($2n = 30$) are markedly different from those found in most other species, their karyotypes displaying two different sizes of chromosomes. This is in marked contrast to the unimodal karyotypes found in species with $2n = 18$. However, species with chromosome numbers less than $2n = 18$ frequently have bimodal karyotypes, a feature explained by descending aneuploidy caused by reciprocal translocation and loss of centromeric fragments. Species with chromosome numbers greater than $2n = 18$ are perhaps amphidiploids originating as a result of hybridization between taxa with chromosome numbers less than $n = 9$.

Both the array of chromosome numbers and the discrepancies in numbers reported by us with those published by Smith-White *et al.* (1970) for *B. diversifolia*, *B. microcarpa*, *B. multifida* and *B. nova-anglica* may in part be the result of misidentification. However, they primarily reflect the morphological complexity of the taxa concerned. More work is required to clarify the delimitation of the various entities in these complexes and therefore discussion of the significance of chromosome numbers in these taxa is premature.

CALOTIS

A genus containing 28 formally recognised species *Calotis* mainly occurs in semi-arid and arid regions of Australia.

Stace (1978, 1982) has reported on the cytoevolution of the genus and noted two significant trends, i.e. a reduction from a base of $x = 8$ down to $x = 4$ in the mainly arid zone annuals, and a high degree of polyploidy. Two-thirds of the species were found to be polyploids and this condition was found to be as frequent in low chromosome number annuals as in high chromosome number perennials.

Our data presented in Table 1 support the observations made by Stace.

CELMISIA

Celmisia contains about 70 species confined to Australia and New Zealand. They are mainly found in alpine regions and most are endemic to New Zealand, only about ten species occurring in Australia. Celmisias are perennial herbs or subshrubs of diverse habit and a cytological survey of 65 species (Hair 1980, Given & Gray 1986) indicates that most are at least 12-ploid, with n = 54. Haploid numbers of n = 54 and n = 108 have been found in Australian species.

CERATOGYNE

Ceratogyne obionoides, the only member of this genus, is an annual species with $n = 6$ and is found throughout much of arid Australia.

ERODIOPHYLLUM

A ditypic genus, *Erodiophyllum* occurs in semi-arid and arid mainland Australia. Both species are perennial herbs with $n = 8$.

TABLE II. SUMMARY OF CHROMOSOME NUMBER DETERMINATIONS IN NATIVE AUSTRALIAN ASTEREAE

	n	2n	
Brachyscome Cass.			
B. aculeata (Labill.) Cass. ex Lessing	9,18 0-6Bs	18	Stace 1981; Watanabe *et al.* 1996
B. aff. ***aculeata*** *(Mt Gingera)*	9 + 1B		Stace 1981
B. aff. ***aculeata*** *(Halls Gap)*	27		Stace 1981
B. augustifolia A.Cunn.ex DC.			
var. ***augustifolia***	9		Smith-White *et al.* 1970
var. ***heterophylla*** (Benth.) G.L.R.Davis	9		Smith-White *et al.* 1970
B. sp. aff. ***augustifolia***	5	10	Watanabe *et al.* 1996
B. basaltica F.Muell.			
var. ***basaltica***	8	16	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996
var. ***gracilis*** Benth.	6	12	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996
B. breviscapis C.R.Carter	4	8	De Jong 1963; Smith-White *et al.* 1970; Carter 1978c; Watanabe & Short 1992
B. campylocarpa J.M.Black	5	10	Smith-White *et al.* 1970, as '*B. campylocarpa* sp. B', Watanabe & Short 1992
B. cardiocarpa F.Muell. ex Benth.	9	36	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. cheilocarpa F.Muell.	9		Carter 1978a; Watanabe *et al.* 1996
B. aff. ***cheilocarpa (A)***		18	Watanabe *et al.* 1996
B. aff. ***cheilocarpa (B)***	9		Watanabe *et al.* 1996
B. chrysoglossa F.Muell.	4	8 + 0-3Bs	mith-White *et al.* 1970; Watanabe & Short 1992
B. ciliaris (Labill.) Less. complex	9,18 27, 361	27,36 81	De Jong 1963; Smith-White *et al.* 1970; Carter 1978a; Watanabe & Short 1992; Watanabe *et al.* 1996

TABLE 11. CONTINUED

	n	2n	
B. ciliocarpa W.Fitzg.	9	18 + 0-2Bs	Carter 1978a; Watanabe & Short 1992; Watanabe *et al.* 1996
B. sp. aff. ***ciliocarpa***	9		Watanabe *et al.* 1996
B. cuneifolia Tate	9	18	Stace 1981
B. curvicarpa G.L.R.Davis	4	8 + 0-5Bs	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996
B. debilis Sond.	3	6	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996
B. decipiens Hook.f.	9,27	18,54	Solbrig *et al.* 1964; Smith-White *et al.* 1970; Watanabe *etal.* 1996
B. dentata Gaudich.	4,8,12 + 0-4Bs	8,16 24 + 0-4Bs	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996
B. dichromosomatica C.R.Carter	2 + 0-3Bs + miero Bs	4 + 0-3Bs +miero Bs	Smith-White 1968, as *B. lineariloba*; Smith-White *et al.* 1970, as '*B. lineariloba* sp. A'; Smith-White & Carter 1970, as '*B. lineariloba* sp. A'; Watanabe *et al.* 1975, as '*B. lineariloba* raee A'; Carter 1978b; Carter 1978e; Smith-White & Carter 1981; Nagl & Pfeifer 1988; Watanabe *et al.* 1991;Watanabe & Short 1992
B. dissectifolia G.L.R.Davis	6,12	12,24	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. diversifolia (Hook.) Fiseher & C. Meyer var. ***diversifolia***	12,16 18,*c.*20	24, 36 + 0-1B	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996

TABLE II. CONTINUED

	n	2n	
B. eriogona (J.M.Black) G.L.R.Davis	4	8	Smith-White *et al.* 1970, as '*B. campylocarpa sp. A*'; Watanabe & Short 1992
B. exilis Sond.	9	18	Carter 1978a; Watanabe *et al.* 1996
B. formosa P.S.Short	9		Short 1988; Watanabe *et al.* 1996
B. glandulosa (Steetz) Benth.		36	Watanabe *et al.* 1996
B. goniocarpa Sond. & F.Muell.	4	8	Watanabe *et al.* 1991; Watanabe & Short 1992
B. gracilis G.L.R.Davis	4	8	Smith-White *et al.* 1970, as *B. diversifolia* var. *dissecta* G.L.R. Davis; Watanabe & Short 1992; Watanabe *et al.* 1996
B. graminea (Labill.) F.Muell.	9	18	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. halophila P.S.Short	9	18	Short 1988; Watanabe & Short 1992; Watanabe *et al.* 1996
B. iberidifolia Benth.	9 + 0-1B	18	De Jong 1963; Chouksanova *et al.* 1968; Gupta 1969; Turner 1970, including specimens referred to *B. bellidioides*; Carter 1978a; Keighery 1978; Gupta & Gill 1983, 1989; Watanabe *et al.* 1996
B. latisquamea F.Muell.	9	18	Carter 1978a; Watanabe *et al.* 1996
B. leptocarpa F.Muell.	3	6	Smith-White *et al.* 1970, probably

TABLE II. CONTINUED

	n	2n	
			conspecific with *B. debilis*
B. lineariloba (DC.) Druce	6,8 4II + 2I	10,12 16	Smith-White 1968; Smith-White *et al.* 1970; Carter & Smith-White 1972; Kyhos *et al.* 1977; Watanabe *et al.* 1985; Watanabe & Smith-White 1987; Watanabe & Short 1992; Watanabe *et al.* 1996; Watanabe *et al.* 1996
B. lyrifolia J.M.Black	9	18	Smith-White *et al.* 1970 and Carter 1978, as to Parachila collections of *B. ciliaris*; Watanabe & Short 1992
B. melanocarpa Sond. & F.Muell.	6,12	12,30	Smith-White *et al.* 1970; Watanabe & Short 1992; Watanabe *et al.* 1996
B. microcarpa F.Muell.	6, 10 10II + 4I	12	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. muelleri Sond.	3	6	Watanabe & Short 1992
B. muelleroides G.L.R.Davis	3	6	Watanabe *et al.* 1996
B. multicaulis F.Muell.	9	18	Watanabe & Short 1992, as *B. rigidula*
B. aff. ***multicaulis***	9	18 + 0-2Bs	Watanabe *et al.* 1996
B. multifida DC. complex	7,9	14,18	Smith-White *et al.* 1970, including var. *dilatata* Benth. and var. *multifida*; Watanabe & Short 1992; Watanabe *et al.* 1996
B. nivalis F.Muell.	11	22	Smith-White *et al.* 1970, excluding record of n = 9, re Stace 1981; Watanabe *et al.* 1996

TABLE II. CONTINUED

	n	2n	
B. nodosa P.S.Short & K.Watan.	3	6	Smith-White *et al.* 1970, as '*B. goniocarpa*; Watanabe & Short 1992, as '*B.* sp. aff. *goniocarpa*'; Short & Watanabe 1993; Watanabe *et al.* 1996
B. nova-anglica G.L.R.Davis	7	14	Smith-White *et al.* 1970, a count of 3n = 18 is probably erroneous; Watanabe *et al.* 1996
B. aff. ***nova-anglica (A)***	5	10	Watanabe *et al.* 1996
B. aff. ***nova-anglica (B)***	6	12	Smith-White *et al.* 1970, as *B. nova-anglica*; Watanabe *et al.* 1996
B. obovata G.L.R.Davis		18	Watanabe *et al.* 1996
B. oucocarpa Diels	9	18	Carter 1978a; Watanabe *et al.* 1996
B. papillosa G.L.R. Davis	4 + 0-2Bs	8	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. parvula Hook.f.	9		Smith-White *et al.* 1970; Carter 1978a
B. perpusilla (Steetz) J.M.Black	9	18,36	Smith-White *et al.* 1970;Carter 1978a; Watanabe & Short 1992; Watanabe *et al.* 1996
B. petrophila G.L.R. Davis		18	Watanabe *et al.* 1996
B. procumbens G.L.R.Davis	9	18	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. ptychocarpa F.Muell.	6	12	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. pusilla Steetz	9	18	Carter1978a; Watanabe *et al.* 1996

TABLE II. CONTINUED

	n	2n	
B. radicans Steetz	13	26	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. rara G.L.R. Davis	6	12	Watanabe & Short 1992
B. readeri G.L.R.Davis	5	10	Watanabe & Short 1992; Watanabe *et al.* 1996
B. rigidula (DC.) G.L.R. Davis	9	18	?Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. riparia G.L.R. Davis	9		Watanabe & Short 1992
B. scapigera (Sprengel) DC.	9	18	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. sieberi DC. var. ***gunnii*** DC.	9 + 0-1B		Stace 1981
B. smithwhitei P.S.Short & K.Watan.	3,6	6,12 + 0-2Bs	Smith-White *et al.* 1970, as '*B. campylocarpa sp. C*'; Watanabe & Short 1992, as '*B.* sp. aff. *campylocarpa*'; Short & Watanabe 1993; Watanabe *et al.* 1996
B. spathulata Gaudich. subsp. ***glabra*** (DC.) Stace	9	18	Stace 1981
subsp. ***spathulata***	9,18,27 36,45		Stace 1981; Watanabe *et al.* 1996
B. stolonifera G.L.R.Davis	15	30	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. stuartii Benth.	6	12	Smith-White *et al.* 1970; Watanabe *et al.* 1996
B. tatei J.M.Black	9	18	Watanabe *et al.* 1996
B. tenuiscapa Hook.f. var. ***pubescens*** (Benth.) G.L.R.Davis	9	18	Smith-White *et al.*

TABLE II. CONTINUED

	n	2n	
			1970; Watanabe *et al.* 1996
aff. var. ***tenuiscapa***		28	Watanabe *et al.* 1996
B. tesquorum J.M.Black	9	18	Smith-White *et al.* 1970
B. tetrapterocarpa G.L.R. Davis	4 + 0-1B	8	Watanabe & Short 1992
B. tractycarpa F.Muell.	27	18 + 0-2Bs, 36	De Jong 1963; Carter 1978a; Watanabe *et al.* 1996
B. sp. aff. ***tractycarpa***	27I or 1III + 0-9II + Is		Watanabe *et al.* 1996
B. uliginosa G.L.R.Davis	9		Smith-White *et al.* 1970
B. whitei G.L.R.Davis	5	10	Smith-White *et al.* 1970;Watanabe & Short 1992
Brachyscome sp.	9		Watanabe *et al.* 1996, referred to *B. iberidifolia*, Fl. S. Aust.
Calotis R.Br.			
C.ancyrocarpa J.M.Black	4	8	Stace 1978
C. anthemoides F.Muell.	7,14	14	Solbrig *et al.* 1964; Stace 1978; Watanabe *et al.* 1996
C. cuneata (F.Muell. ex Benth.) G.L.R.Davis	16	32 + 0-10Bs	Stace 1978; Watanabe *et al.* 1996
C. cuneifolia R.Br.	8,16	16,32	Solbrig *et al.* 1964; Stace 1978; Watanabe *et al.* 1996
C. cymbacantha F.Muell.	7,14	28	Stace 1978; Watanabe *et al.* 1996
C. dentex R.Br.	8	16	Stace 1978; Watanabe *et al.* 1996

TABLE II. CONTINUED

	n	2n	
C. erinacea Steetz	7,14 21,28	14,28 56	Turner 1970; Stace 1978; Watanabe *et al.* 1996
C. glandulosa F.Muell.	8	16	Stace 1978
C. hispidula (F.Muell.) F. Muell.		16	Stace 1978
C. inermis Maiden & Betche	8	16	Stace 1978
C. lappulacea Benth.	14		Stace 1978; Watanabe *et al.* 1996
C. ? aff. *lappulacea*	8		Watanabe *et al.* 1996
C. latiuscula F.Muell. & Tate	7,14 28	14,21	Stace 1978, 1982
C. multicaulis (Turcz.) Druce	4,8	8,16	Turner 1970; Stace 1978, as *C. multicaulis* sp. B; Watanabe *et al.* 1996
C. plumulifera F.Muell.	5 + 02Bs	10,20	Stace 1978, as *C. multicaulis* sp. B; Watanabe *et al.* 1996
C. porphyroglossa F. Muell.	10	20	Stace 1978
C. scabiosifolia Sond. & F.Muell. var. *integrifolia* F.Muell. ex Benth.	8,16	16,32	Stace 1978
var. *scabiosifolia*	8,16	16,32	Stace 1978; Watanabe *et al.* 1996
C. scapigera Hook.	8,16		Stace 1982; Watanabe *et al.* 1996
C. squamigera C.T.White		16	Stace 1978
C. xanthosoidea Domin	8	16	Stace 1978
Celmisia Cass.			
C. asteliifolia Hook.*f.* complex	54 108	108 216	Hair 1980
C. longifolia Cass. complex	54 108	108	Hair 1980
C. sericophylla J.H.Willis		108	Hair 1980
Ceratogyne Turcz.			
C. obionoides Turcz.		6	Turner 1970

TABLE II. CONTINUED

	n	2n	
Erodiophyllum F.Muell.			
E. acanthocephalum Stapf	8		Solbrig *et al.* 1964
E. elderi F.Muell.		16	Watanabe *et al.* 1996
Isoetopsis Turcz.			
I. graminifolia Turcz.	17		Turner 1970
Kippistia F.Muell.			
K. suaedifolia F.Muell.	9		Short 1986; Watanabe *et al.* 1996
Lagenifera Cass.			
L. huegelii Benth.	9	18	Turner 1970; Watanabe *et al.* 1996
L. stipitata (Labill.) Druce	9	18	Smith-White *et al.* 1970; Watanabe *et al.* 1996
Minuria DC.			
M. cunninghamii (DC.) Benth.	9	18	Turner 1970; Watanabe *et al.* 1996
M. gardneri Lander & R.Barry	9		Watanabe *et al.* 1996
M. integerrima (DC.) Benth.	18		Watanabe *et al.* 1996
M. leptophylla DC	9 0-2Bs	18 + 1986;	Turner 1970; Short Watanabe *et al.* 1996
Olearia Moench			
O. adenolasia F.Muell.	9		Turner 1970
O. algida N.A.Wakef.		18	Beuzenberg & Hair 1984
O. argophylla F.Muell.	54		Solbrig *et al.* 1964
O. astroloba Lander & N.G.Walsh	9		Short in Lander & Walsh 1989
O. astrotricha (F.Muell.) F.Muell. ex Benth.	9		Watanabe *et al.* 1996
O. axillaris (DC.) F.Muell. ex Benth.	9		Solbrig *et al.* 1964
O. ciliata (Benth.) F.Muell. ex Benth.	9		Turner 1970; Watanabe *et al.* 1996
O. ferresii (F.Muell.) F.Muell. ex Benth.	9		Watanabe *et al.* 1996

TABLE II. CONTINUED

	n	2n	
O. floribunda (Hook.f.) Benth.	9		Pai 1964
O. frostii (F.Muell.) J.H.Willis		18	Beuzenberg & Hair 1984
O. humilis Lander	9		Turner 1970, as *Olearia* sp.; Short in Lander 1989; Watanabe *et al.* 1996
O. imbricata (Turcz.) Benth.	9		Watanabe *et al.* 1996
O. muelleri (Sond.) Benth.	9		Turner 1970
O. pannosa Hook.		90	Beuzenberg & Hair 1984
O. phlogopappa (Labill.) DC. complex	9,18		Solbrig *et al.* 1964; Watanabe *et al.* 1996
O. pimelioides (DC.) Benth.	9	18 + 0-2Bs	Turner 1970, and as *O. propinqua*; Watanabe *et al.* 1996
O. plucheacea Lander	9		Short in Lander 1990; Watanabe *et al.* 1996
O. ramulosa (Labill.) Benth. complex	9		Watanabe *et al.* 1996
O. rudis (Benth.) Benth.	9		Turner 1970; Watanabe *et al.* 1996
O. stuartii (F.Muell.) F.Muell. ex Benth	9		Short in Lander 1989; Watanabe *et al.* 1996.
O. xerophila (F.Muell.) Benth.	9		Watanabe *et al.* 1996
Olearia sp.	9		Watanabe *et al.* 1996, syn. *Eurybia dampieri* DC.
Solenogyne Cass.			
S. bellidioides Cass.	9		Smith-White *et al.* 1970; Adams 1979
S. dominii L.G.Adams	9	18	Adams 1979; Watanabe *et al.* 1996
S. gunnii (Hook.f.) Cabrera	9		Adams 1979
Vittadinia A.Rich.			
V. cuneata DC.			

TABLE II. CONTINUED

	n	2n	
var. ***hirsuta*** N.T.Burb.	9	18	Watanabe *et al.* 1996
V. dissecta (Benth.) N.T.Burb. var. ***hirta*** N.T.Burb.	9		Turner 1970, as *V. triloba* & *Vittadinia* sp.
V. gracilis (Hook.f.) N.T.Burb.	9		Watanabe *et al.* 1996
V. muelleri N.T.Burb.	9		Watanabe *et al.* 1996
V. pterochaeta (F.Muell. ex benth.) J.M.Black	9		Watanabe *et al.* 1996
V. pustulata N.T.Burb.	9		Watanabe *et al.* 1996
V. sulcata N.T.Burb.	9		Watanabe *et al.* 1996

ERIGERON

Given (1973) and Given & Gray (1986) noted that Australian species of *Erigeron* should be excluded from that genus. Nesom (1994a,b) has subsequently referred most Australian species to three genera, i.e. *Iotasperma* Nesom, *Lagenithrix* Nesom and *Pappochroma* Labill. (syn. *Lagenopappus* Nesom), but has left the placement of *E. conyzoides* F.Muell. unresolved. Cladistic studies (by PSS) in Australian Astereae do not wholly support Nesom's treatment and will be the subject of a future paper.

The alpine *E. pappochroma* complex (*Lagenithrix* & *Pappochroma* sensu Nesom) seemingly has affinities with the *Olearia-Celmisia* complex (Given & Gray 1986) and could be expected to have a base of $x = 9$.

The count of $2n = 36$ for the introduced *E. karvinskianus* is consistent with those obtained by Montgomery & Yang (1960, as *E. mucronatus* DC.).

LAGENIFERA & SOLENOGYNE

Whether or not *Solenogyne* is deserving of generic rank or should be relegated to synonymy under *Lagenifera* has been the subject of debate for some years (Drury 1974, Adams 1979). They are here maintained as separate genera pending further work. All species are perennials and tend to be found in mesic conditions. Our chromosome number determinations, i.e. $n = 9$ and $2n = 18$, are consistent with the observations of previous workers (Smith-White *et al.* 1970, Turner 1970, Adams 1979).

KIPPISTIA & MINURIA

Eleven species are currently placed in this genus (Lander & Barry 1980b, Lander 1987b, Short 1991) although one, *M. macrorhiza*, should possibly be reinstated as *Eurybiopsis* (see below). All but one, *M. annua* (Tate) J.M.Black, are apparently perennial herbs or small shrubs although several, including *M. multiseta* P.S.Short may be short lived. We have confirmed earlier reports of $n = 9$ for *M. cunninghamii* and *M. leptophylla* (Turner 1970, Short 1986) and here record the tetraploid condition for *M. integerrima*. The presence of B chromosomes is here reported for the first time in this genus.

Kippistia, a monotypic genus, at one time relegated to synonymy under *Minuria* but reinstated by Lander & Barry (1980a), is seemingly very closely related to the latter genus. *K. suaedifolia* is a small shrub with $n = 9$.

OLEARIA

Olearia consists of about 180 species and occurs in Australia, New Guinea and New Zealand. About 130 species occur in Australia (Lander 1992) and the genus is currently under revision. All species are shrubs and the genus is widespread in alpine, temperate and arid regions of Australia. Few species have been cytologically examined but our data are consistent with the finding for New Zealand species that the base number is $x = 9$. However, most Australian species are diploids, a contrast to the situation in New Zealand where only 12-, 14-, 32- and 48-ploid levels have been recorded (Beuzenberg & Hair 1984). For the first time B chromosomes are also reported for this genus, having been observed by us in *O. pimelioides*.

VITTADINIA, CAMPTACRA & EURYBIOPSIS

Burbidge (1982) revised *Vittadinia* and recognised 29 species, most of which are confined to Australia. She segregated two further genera, describing ditypic *Camptacra* (Lander 1987b) and reinstating monotypic *Eurybiopsis*. Lander (1987a) has subsequently reduced *Eurybiopsis* to synonymy under *Minuria* although more recent work by Wiggins (1990) suggests that the former genus should be maintained.

Chromosome counts are lacking for *Camptacra* and *Eurybiopsis* and until now for all but one species of *Vittadinia*. Chromosome numbers are now known for seven species (Table II). Of these, three are, or possibly are, annuals. All seven species have $n = 9$. One of these is more or less confined to temperate areas, the others extend from temperate to arid areas.

Base numbers and comparisons

With the exception of *Isoetopsis*, which possibly should be placed in the Gnaphalieae (Bremer & Humphries 1993), ditypic *Erodiophyllum*, monotypic *Ceratogyne*, and the essentially arid-zone genus *Calotis*, all Australian genera for which data are available have one or more species with $n = 9$ or a base number that is a multiple of 9. Therefore, it seems reasonable to conclude that $x = 9$ is the base number for the Australian Astereae, a conclusion that is in keeping with previous findings for the tribe Astereae (Raven *et al.* 1960, Solbrig *et al.* 1964, 1969). Following a survey of mainly Northern Hemisphere genera (38 out of 53) and some Southern Hemisphere genera (22 out of 65) *Solbrig et al.* (1964) also noted that many species with low chromosome numbers ($n = 4$ & 5) belong to mainly annual genera that are concentrated in southwestern North America and that low numbers were probably correlated with dry habitats. As noted above, the same correlations are apparent in annual species of *Brachyscome* 'subgenus *Eubrachyscome*', *Calotis* and *Ceratogyne*. Chromosomal variation in Australian Astereae is clearly similar to that found in North America. In fact, although fewer chromosome number determinations were available to him, Turner (1970) previously suggested this to be the case, not just for the tribe Astereae, but the entire family.

Acknowledgement

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Elaeocarpus (Elaeocarpaceae) endocarps from the Early to Middle Miocene Yallourn Formation of Eastern Australia

Andrew C. Rozefelds[1] *& C. Christophel*[2]

[1] Tasmanian Herbarium, G.P.O. Box 252C, Hobart, 7001, Tasmania, Australia.
[2] Department of Botany, University of Adelaide, G.P.O. Box 496, Adelaide, 5005, South Australia, Australia.

ABSTRACT
Elaeocarpus cerebriformis sp nov. is described, from near the base of the middle to late Miocene Yallourn Formation of south-eastern Victoria. The ellipsoid, usually trilocular endocarp, and bastionate external ornamentation of the endocarp wall suggest affinities with an undescribed extant taxon from montane areas of north eastern Queensland.

Introduction

The Elaeocarpaceae is a moderately large, essentially southern hemisphere family with about 520 species in nine genera (M. Coode *pers comm.* 1995). Fruit morphology is variable in the family with dehiscent ± woody fruits (*Sloanea, Peripentadenia, Dubouzetia*), berries (*Sericolea, Aristotelia*), and drupes (*Elaeocarpus*, *Aceratium*). The endocarp in *Aceratium* is generally weakly lignified and has prominent and persistent mesocarp fibres, while in *Elaeocarpus* the endocarps are generally woody, strongly ornamented and lack persistent mesocarp fibres. An exception is *E. johnsonii* F.Muell. which has persistent mesocarp fibres, and the endocarp is not woody. The fossil fruits described here are hard, woody, strongly ornamented drupes and therefore are referable to *Elaeocarpus*.

Elaeocarpus has been recognised as a ubiquitous element of the Tertiary floras of eastern Australia, because of the distinctive morphology of the endocarps, and also because the woody endocarps are robust and survive fossilisation (Kirchheimer 1935, Selling 1950, Rozefelds 1990a, Blackburn & Sluiter 1994, Rozefelds & Christophel 1996). The affinities of many of the fossil endocarps that have been compared with, or referred to *Elaeocarpus*, remain poorly studied. The present material was collected from near the base of the Yallourn Formation. It was identified as *Elaeocarpus* by Blackburn (1985), and mentioned by Blackburn & Sluiter (1994, p. 346) who also commented that 'pollen types that are comparable with the genus *Elaeocarpus* are common throughout the Yallourn and Morwell coal seams'. Christophel (1994) also illustrated these same specimens but did not examine the systematic placement of this material in more detail. The Yallourn Formation is considered to be Early to Middle Miocene, and is part of the *Triporopollenites bellus* palynological Zone (Blackburn & Sluiter 1994). Holdgate *et al.* (in press) suggest the Yallourn Seam covers a period of about a million years from 16.5 to 15.5 m. y., at the Early-Middle Miocene boundary (A. P. Kershaw pers comm. 1995).

In this paper, the systematic relationships of this taxon are examined, based upon a comparative study of the endocarps of extant Australian and New Zealand taxa (Rozefelds 1990b, Rozefelds & Christophel in. prep.). A study of endocarps of extant *Elaeocarpus* species from New Zealand and Australia (Rozefelds 1990b, Rozefelds & Christophel in prep.) showed that endocarp morphology is highly variable (Table 2). Similarities in endocarp morphology between the fossil and extant *Elaeocarpus* taxa are recognised and the biogeographical implications of these fossil taxa are discussed.

Materials and methods

The material studied is preserved as 'charcoalified' fruits. Prior to photographing the

TABLE 1. LIST OF EXTANT MATERIAL EXAMINED, INCLUDING LOCALITY, COLLECTOR AND SOURCE OF MATERIAL

Taxon	Locality	Collector
E. arnhemicus F.Muell.	Kennedy River, 15°26'S, 144°11'E SFR 607, Bridle L. A., 16°59'S, 145°36'E	Hyland 11243 (QRS) Gray 2164 (QRS)
E. coorangooloo J.F.Bailey & C.T.White	Mazlin Ck, Tolga-Atherton Road	Hyland 12637 (QRS)
E. grandis F. Muell.	SFR 310, Upper Goldsworthy L. A. 17°14'S, 145°06'E. Noah Creek, Cape Tribulation Area	Gray 2749 (ex QRS) A.C.Rozefelds Coll.
E. ruminatus F.Muell.	SFR 194, Parish of Barron, 17°28'S, 145°28'E.	Gray 3669 (QRS)
E.williamsianus Guymer	near Burringbar, New South Wales	AQ348209 (BRI)
***E.* sp. nov. 1**	SFR 185, Kauri Logging Area, 900m, 17°10'S, 145°35'E	Sanderson 6 (QRS)

TABLE 2. ORNAMENTATION TYPES IN SELECTED EXTANT AND FOSSIL *ELAEOCARPUS* SPECIES, BASED UPON ROZEFELDS AND CHRISTOPHEL (IN PREP.)

Ornamentation Types	Description of Ornamentation in T. S.	Extant Australian species with ornamentation type	Fossil taxon with ornamentation type
Baculate	Rod-like, the maximum diameter of rod is less than height	*E. arnhemicus* F.Muell.	
Bastionate	Width of the bastionate processes is greater than the distance between processes, processes expanded distally	*E. grandis* F.Muell. *E. williamsianus* Guymer *E. sp. nov.*	*E. spackmaniorum* Rozefelds *E. mackayii* (F.Muell.) *E. cerebriformis* Rozefelds & Christophel (herein)
Echinate	Pointed sculptural elements, the largest diameter can be greater or smaller than height	*E. carolinae* Hyland & Coode *E. culminicola* Warb. *E. eumundi* F.M.Bailey *E. ruminatus* F.Muell. *E. reticulatus* Sm.	*E. cunningii* Rozefelds
Granulose	circular to subcircular rounded or grainlike processes	*E. elliffii* Hyland & Coode *E. sericopetalus* F.Muell.	
Punctate	marked with irregularly scattered depressions	*E. bancroftii* F.Muell. & F.M. Bail. *E. linsmithii* Guymer *E. stellaris* L.S.Smith	*E. clarkei* (F.Muell.) *E.* sp. nov. Rozefelds & Christophel, in press
Smooth	uniform relief	*E. thelmae* Hyland & Coode *E. ferruginiflorus* C.T.White *E. foveolatus* F.Muell. *E. largiflorens* C.T.White	
Verrucate	Irregular rounded to globular structures	*E. coorangooloo* J.F.Bailey & C.T.White	

fossil endocarps, the material was whitened with ammonium chloride to highlight surface features and ornamentation. Modern endocarps were photographed without whitening. SEM examination of extant endocarps yielded few additional insights that were not available from examining the material with light microscopy. Comparative extant material of North Queensland *Elaeocarpus* species was provided by CSIRO, Atherton (QRS) and Brisbane (BRI) and the material examined is listed in Table 1. Fossil material is lodged in the Department of Botany, University of Adealide

Results

SYSTEMATICS

Family: Elaeocarpaceae

Elaeocarpus L.

Type species *Elaeocarpus serratus* L.

Elaeocarpus cerebriformis Rozefelds and Christophel *sp. nov.*

Elaeocarpus sp. in Blackburn, 1985, p. 49-50, pl 28, a, b, d. *Elaeocarpus* sp. in Christophel, 1994, fig. 2.10E.

DIAGNOSIS

Distinguished from other *Elaeocarpus* species by the following combination of characters: ellipsoid, 10.1–12.2 mm long, 7.0–8.1 mm wide, three-partite endocarps; bastionate ornamentation, 0.7–0.8 mm high.

DESCRIPTION

Woody endocarp, ellipsoid in lateral view, with three sutures, less frequently two sutures, 10.1-12.2 mm long by 7.0-8.1 mm wide. Apex and base of endocarp rounded in lateral view. Prominent bastionate ornamentation (0.7-0.8 mm high), consisting of irregularly shaped ridges which arise perpendicularly from base of endocarp wall, giving a cerebriform appearance. Wall of endocarp 1.1-1.2 mm thick. Sutures recessed, below ornamentation. Locule in UAY004 is 5.6 mm long by 3.4 mm wide. Seed anatropous, ellipsoid in lateral view, apex broadly rounded.

HOLOTYPE: UAY001. TYPE LOCALITY: Yallourn Formation, Yallourn Coal Mine, Latrobe Valley, Victoria (38°12'S, 146°20'E). (Fig. 1)

ETYMOLOGY

For the cerebriform, brain-like external appearance of the endocarps.

MATERIAL EXAMINED

UAY001-004, Yallourn Formation, Latrobe Valley, Victoria. (Fig. 1)

REMARKS

The endocarp in *Elaeocarpus cerebriformis* (Fig. 2) is ellipsoid in outline, with usually three recessed sutures and bastionate ornamentation. The three sutures indicate that the endocarp was derived from a three locular ovary. In the developed fruit only one locule is evident as the other two have been compressed by growth of the fertile locule. The wall of the seed is preserved but details of the internal structure of the seed are not preserved. Groups of taxa within *Elaeocarpus* can be identified by their endocarp morphology, particularly ornamentation types and endocarp shape (Table 2). The various ornamentation types are given in Table 2. Three extant Australian species have bastionate ornamentation: *E. grandis* F.Muell., *E. williamsianus* Guymer, and an undescribed taxon (*Elaeocarpus* sp. nov. 1, Coode 1984) from north eastern Queensland (Fig. 1; Table 2). The first two taxa have spherical endocarps and hence differ from the ellipsoid endocarps of the fossil material being described here. *Elaeocarpus grandis* also differs from *E. cerebriformis* in that the non-fertile locules are not obscured by growth of the fertile locule (Fig. 4A). The ellipsoid form of the usually trilocular endocarp, and

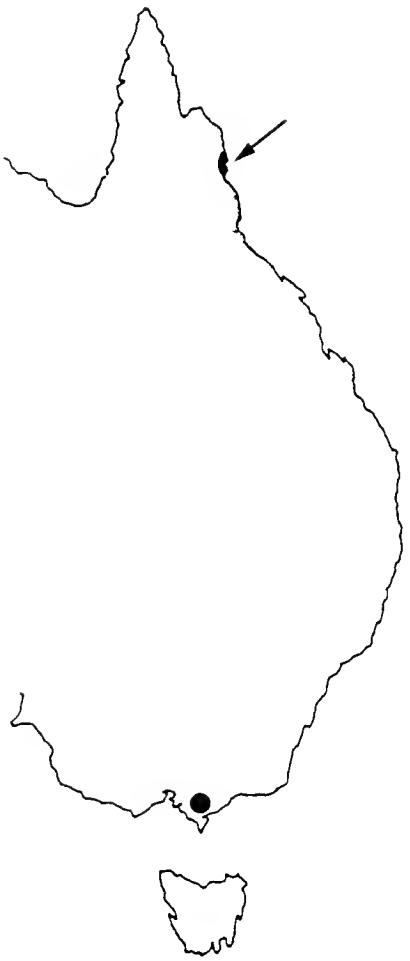

Fig. 1. Fossil record of fossil *Elaeocarpus cerebriformis* and the modern distribution of extant *Elaeocarpus* sp. nov. is arrowed.

bastionate ornamentation suggest affinities with *Elaeocarpus* sp. nov. 1 from north eastern Queensland. The endocarps of *Elaeocarpus* sp nov. 1 differ from *E. cerebriformis* in being larger c. 14 x 10 mm (Coode 1984), and the ornamentation is also more pronounced i.e. (0.7-1.5 mm high). *Elaeocarpus* sp nov. 1 (*Sanderson 6,* Fig. 3) is restricted to montane heath and rain forest, at Thornton Peak, and the Windsor Tableland, in north-eastern Queensland (Coode 1984).

Coode (1984) was uncertain of the infra-generic placement of *Elaeocarpus* sp. nov. 1, because flowers were not known. He compared it to *E. coorangooloo* using fruit and seed characters. The endocarp of *E. coorangooloo*, like *Elaeocarpus* sp. nov. 1 is ellipsoid in lateral view. It differs from *E. cerebriformis*, in the more rounded, verrucate ornamentation of the endocarps, and usually bilocular endocarp. *Elaeocarpus arnhemicus* is also comparable to *E. cerebriformis* in that it has ellipsoid endocarps, with prominent processes. It also differs from *E. cerebriformis* in having a bilocular endocarp, and the processes are baculate in form.

Coode (1984) emphasised the importance of seed characters, in defining groups within *Elaeocarpus,* particularly whether the embryo was curved or straight. The wall of the seed is preserved in *E. cerebriformis* but it is not possible to determine whether the embryo was curved or straight (Fig. 4A). *Elaeocarpus arnhemicus*, *E. coorangooloo* and *E.* sp. nov. 1 all have straight embryos. It would seem likely therefore that *E. cerebriformis* also had a straight embryo. The alternative possibility is that the trilocular condition in *E. cerebriformis* implies affinities to the *E. foveolatus* group or *E. ruminatus*, although the ornamentation in these taxa differs in being smooth or echinate (Table 2, Figs. 4B & 4C).

Two fossil taxa, *E. mackayii* (F.Muell.) Kirchheimer and *E. spackmaniorum* Rozefelds, have bastionate ornamentation and could be compared to *E. cerebriformis* (Table 2). These taxa both differ from *E. cerebriformis* in being spherical in shape. *Elaeocarpus spackmaniorum* also differs from *E. cerebriformis* in that the non-fertile locules are not obscured by the development of the fertile locule.

Discussion

Elaeocarpaceae pollen of uncertain affinities were recorded from the Latrobe Valley Coal Measures (Luly *et al.*, 1980, Sluiter & Kershaw 1982). Blackburn & Sluiter (1994)

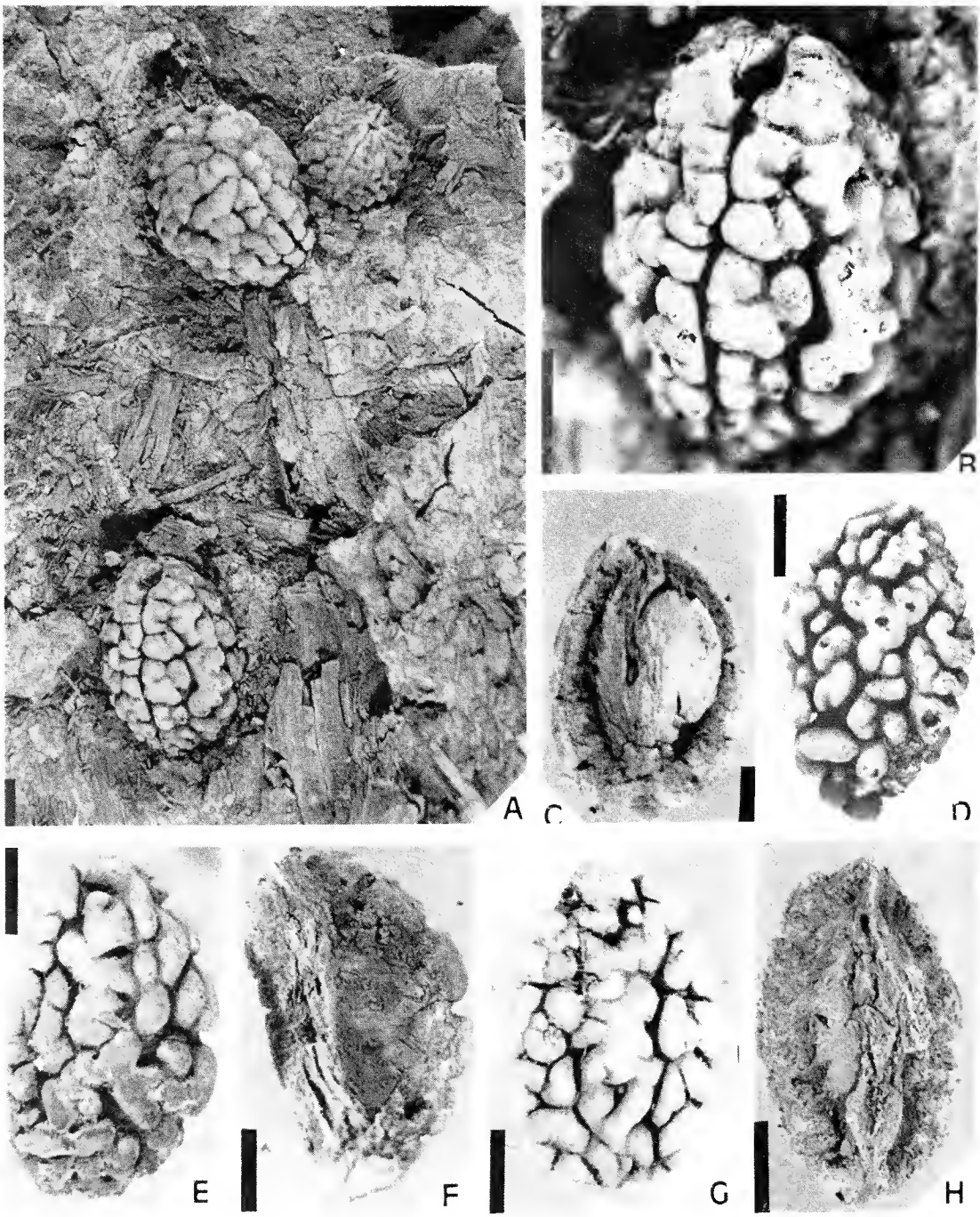

Fig. 2. *Elaeocarpus cerebriformis* from Yallourn Formation, Yallourn Coal Mine, Victoria. a - Holotype (UAY001) and paratype (UAY002) in matrix, Holotype lower specimen. b - Holotype enlarged to show details of prominent bastionate ornamentation. c - Internal view of part of endocarp (UAY004) showing anatropous seed in place. d - External view of part of endocarp (UAY003) showing bastionate ornamentation. e-h - External and internal views of parts of the endocarps of paratype (UAY004), illustrating the variation in ornamentation within one endocarp. Scale bars = 0.25 cm.

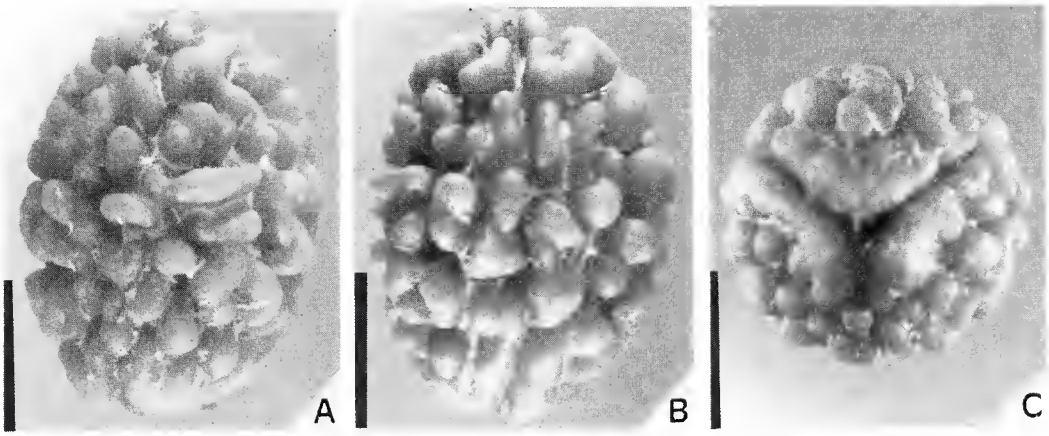

Fig. 3. *Elaeocarpus* sp. nov. 1 (Sanderson 6). a - Mesosutural view. b - Sutural View. b - Apical view. Scale bars = 0.5 cm.

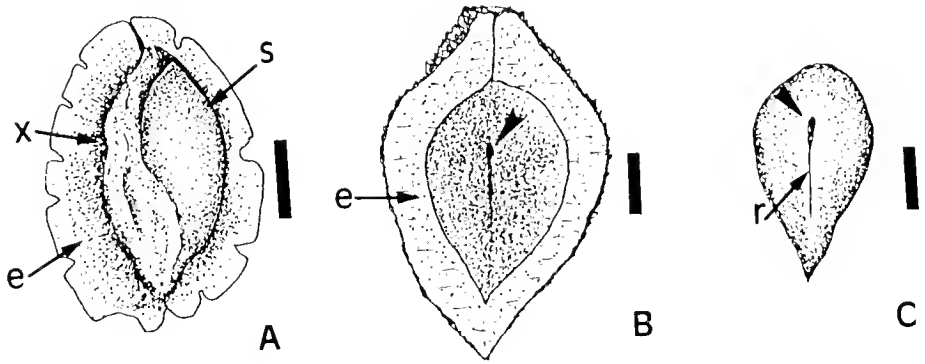

Fig. 4.**a** - *Elaeocarpus cerebriformis*. Drawing of part of endocarp of UAY004, showing seed in place in locule, and an adjacent compressed locule. **b** - Longitudinal section through endocarp of *E. ruminatus* with seed removed showing the attachment scar. **c** - Seed of *E. ruminatus* showing attachment scar (arrowed) and raphe. (e, endocarp; x, compressed locule; s, seed; r, raphe). Scale bars = 0.25 cm.

considered that some of Elaeocarpaceae pollen types were comparable with *Elaeocarpus*. The fossil endocarps, and probably the pollen, indicate that *Elaeocarpus* was a ubiquitous element of the Yallourn palaeoflora.

Elaeocarpus in Australia is essentially a rain forest genus restricted to mesic forest communities. This fruit record would support the existing palynological literature that rain forest communities were present in the Early to Middle Miocene in the Yallourn area (Sluiter & Kershaw 1982). Interseam clays at the base of the Yallourn Formation have also yielded fruits i.e. Menispermaceae, Vitaceae and Proteaceae with rain forest affinities (Rozefelds 1995).

A diverse range of ornamentation types occurs in the endocarps of extant *Elaeocarpus* species in Australia (Table 2). Most of these ornamentation types are represented by taxa in north eastern Queensland, which is the centre of diversity for the genus in Australia. Fossil taxa with a range of ornamentation types have also been recognised in mid Tertiary deposits in eastern Australia. The new fossil taxon *E. cerebriformis*, and previously described *E. spackmaniorum* Rozefelds and *E. mackayii* (F.Muell.) Kirchheimer, have bastionate ornamentation. *Elaeocarpus cunningii* Rozefelds has echinate ornamentation, and Rozefelds & Christophel (1996) are describing taxa with punctate ornamentation (Table 2). The extensive fossil record of *Elaeocarpus* in Australia, as exemplified by the diversity of fruit morphotypes in the mid-Tertiary, indicates that the genus was morphologically diverse at this time. The fossil record of *Elaeocarpus* in southern and eastern Australia also suggests that montane and lowland rain forests near Cairns, in north eastern Queensland, are a refugia for taxa with affinities to these mid-Tertiary species.

A number of endemic *Elaeocarpus* species in north eastern Queensland (e.g. *E. sp. nov.*, *E. linsmithii*, *E. thelmae*, *E. johnsonii*) are restricted to montane habitats. Endemism is common in montane floras in tropical and subtropical regions e.g. Hawaii and Afro-alpine floras of eastern African mountains (Stott 1981, Cox & Moore 1980). A high level of endemicity also occurs in *Elaeocarpus* in New Guinea and New Caledonia and this is probably related to the physiographic and edaphic variation of these islands (Coode 1978, Tirel 1982). Stott (1981) presented two hypotheses to explain the origin of mountain endemics; i.e. that the isolated conditions in montane floras, prevents inflow of potential competitors and evolution is accelerated, and the relictual populations differentiate through adaptive radiation and vicariance. Alternatively, Stott (1981) proposed that these relictual floras have been stranded on mountain tops through climatic change.

The most closely related taxon to *Elaeocarpus cerebriformis* occurs in montane rain forests in north eastern Queensland. The Yallourn Formation was a low altitude depositional environment, and the presence of the closest analogue in high altitude montane forests suggests possible altitudinal change, and reduction in range, and/or migration since the mid-Miocene. Reduction in range and/or migration of taxa, and altitudinal displacement, can be correlated generally with the increasing aridity of the climate from the Miocene onwards (Sluiter & Kershaw 1982).

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An annotated list of the taxa of fungi in the published Australian papers of H.J. Swart

J.A. Simpson[1] *& C.A. Grgurinovic*[2]

[1] Researeh Division, State Forests of N.S.W., P.O. Box 100, Beecroft, 2119, New South Wales, Australia.
[2] Australian Biological Resources Study, G.P.O. Box 636, Canberra, 2601, Australian Capital Territory, Australia.

ABSTRACT
The taxa of fungi in the papers on Australian fungi by Dr H.J. Swart are listed in alphabetical order. Subsequent changes in classification or nomenclature are noted. Pathogens are listed also under hosts. One new eombination is made, namely, *Vermisporium samuelii*.

Introduction

Between 1966 and 1989 Dr Haring ('Harry') Johannes Swart was employed as a mycologist in the School of Botany, at The Univcrsity of Melbourne. In those years he published alone or with various co-authors 42 papers on aspects of Australian mycology. His particular interest became the leaf-inhabiting fungi of the native plants of south-eastern Australia where he made an outstanding contribution (Parbery, 1994). Dr Swart published the results of his Australian studies only in the *Transactions of the British Mycological Society*. Though generally short the papers were wide ranging and dealt with a very large number of taxa. Swart & Williamson (1983) also published a recipe for *Eucalyptus* agar though it does not seem to have been widely used. To facilitate reference to this invaluable literature by mycologists, ecologists, and those eoncerned about biodiversity in Australia, we have prepared an annotated list of the fungal taxa referred to in the published papers of Dr Swart.

There have been substantial changes in recent years in concepts of many of the taxa studied by Swart e.g. the *Monochaetia*, *Pestalotia*, *Seimatosporium* complex (Nag Raj 1993), Leotiales (Spooner 1987), pyrenomycetous ascomycetes (Barr, 1990, 1994) and bitunicate ascomycetes where Swart followed the classification of Müller & von Arx (1962) and von Arx & Müller (1975). We have attempted to use the most up to date nomenclature. Order and family have been included for ascomycete genera using the classification of Eriksson & Hawksworth (1993). However, orders and families have been omitted for the Dueteromycotina. We have also listed pathogens reported by Swart under the name of the host species but using the nomenclature of Chapman (1991).

Taxa in **bold** are deseribed and usually beautifully, illustrated. Numbers in **bold** refer to the volume number of *Transactions of the British Mycological Society*; lower case numbers give the first page in each paper where a species or one of its synonyms is cited. Names of authors of plant names are abbreviated according to Brummitt & Powell (1992).

Fungi

Alatospora acuminata Ingold **86**: 497.
Allelochaeta gaubae Petr. = *Diploceras dilophosporum*.
Alternaria brassicicola (Sehwein.) Wiltshire **60**: 129.
Amerostege latitans (Sace.) Theiss. = *Clypeophysalospora latitans*.
Amphichaeta europaea Grove = *Seimatosporium hysterioides*.
Amphichaeta grevilleae Loos = *Sarcostroma grevilleae*. Nag Raj (1993) did not aecept

Swart's opinion (**72**: 405) that *A. grevilleae* is a synonym of *Seimatosporium kennedyae*.

Amphichaeta kennedyae McAlpine = *Sarcostroma kennedyae*.

Anguillospora crassa Ingold **86**: 497.

Anixiopsis fulvescens (Cooke) de Vries var. *stercoraria* (Hansen) de Vries = *Aphanoascus fulvescens*.

Anthracostroma persooniae (Henn.) Petr. (Dothideales) **84**: 733. Teleomorph of *Camarosporula persooniae*. The family placement of *Anthracostroma* Petr. is uncertain.

Aoria Cif. **87**: 99.

Aphanoascus fulvescens (Cooke) Apinis (Onygenales: Onygenaceae) **79**: 508. The genus *Ascophanus* Zukal was revised by Cano & Guarro (1990).

Aphanostigme Syd. (Dothideales: Dimeriaceae) **91**: 456.

Apiothyrium arcticum Petr. (order uncertain: Hyponectriaccae) **90**: 449.

Apiothyrium tasmanicum H.J.Swart (Hyponectriaceae) **90**: 448. The Hyponectriaceae are included in either the Xylariales or Phyllachorales (Barr, 1990).

Arnaudiella Petr. (Dothideales: Microthyriaceae) **87**: 86. Swart suggested *Microthyrium eucalypticola* might be better placed in *Arnaudiella*. Crous & Kendrick (1994) have described a species of *Arnaudiella* and its *Xenogliocladiopsis* anamorph from *Eucalyptus* from South Africa.

Arnaudiella bancroftii Hansf. = *Phaeothyriolum microthyrioides*.

Articulospora tetracladia Ingold **86**: 497.

Articulospora sp. **86**: 497.

Ascocoma H.J.Swart (Leotiales: Phacideaceae) **87**: 606. See also **90**: 287.

Ascocoma eucalypti (Hansf.) H.J.Swart **87**: 607. Anamorph, by association only, is *Coma circularis*.

Ascocoma eucalypti var. ***didymospora*** H.J.Swart **87**: 607.

Asperopilum juncicola Spooner (Leotiales: Hyaloscyphaceae) **80**: 550.

Aspergillus clavatus Desm. **64**: 513.

Asterina sp. **57**: 460; **65**: 84; **91**: 459.

Asterina baileyi Berk. & Broome = *Placoasterella baileyi*.

Asterina banksiae Hansf. **53**: 322. An invalid name suggested by Hansford (1954) who provided no Latin description.

Asterina correicola Cooke & Massee (Dothideales: Asterinaceae) **53**: 323.

Asterina microthyrioides G. Winter = *Phaeothyriolum microthyrioides*.

Asterina sepulta Berk. & M. A. Curt. = *Dothidasteromella sepulta*.

Asterina systema-solare Massee = *Dothidasteromella systema-solar*.

Asterina systema-solare Massee var. *minor* E. E. Fisher. = *Dothidasteromella systema-solare*.

Asterinella baileyi (Berk. & Broome) Petr. = *Placoasterella baileyi*.

Aulographina eucalypti (Cooke & Massee) Arx & E. Müll. (Dothidcales: Asterinaceae) **87**: 90; **87**: 603; **90**: 286. Anamorph is *Thyrinula eucalypti*.

Aulographum eucalypti Cooke & Massee = *Aulographina eucalypti*.

Balansia Speg. (Hypocreales: Clavicipitaceae) **79**: 566.

Balladynella banksiae (Sacc. & Bizz.) Hansf. = *Episphaerella banksiae*.

Beauveria bassiana (Bals.-Criv.) Vuill. **79**: 507.

Blasdalea Sacc. & Syd. (Dothideales: Vizellaceae) **57**: 456.

Blastacervulus H.J.Swart **90**: 289.

Blastacervulus eucalypti H.J.Swart **90**: 289.

Botryosphaeriaceae Theiss. & Syd. (Dothideales) **57**: 457.

Botryosphaeria banksiae Hansf. = *Coccodiella banksiae*.

Broomella Sacc. (Xylariales: Amphisphaeriaceae) **61**: 73; 79. Anamorphs are species of *Pestalotiopsis* and *Truncatella* Steyaert.

Camarosporula persooniae (Henn.) Petr. **84**: 733. Anamorph of *Anthracostroma persooniae*.

Camposporium antennatum Harkn. **86**: 497.

Camptomeris acaciae (Syd.) Cif. = *Colletogloeum acaciicola.*
Candelabrum brocchiatum Tubaki **86**: 497.
Candelabrum spinulosum Beverw. **86**: 497.
Candelabrum sp. **86**: 497.
Casaresia sphagnorum Gonz. Frag. **86**: 497.
Ceuthospora innumera Massee **90**: 280. The teleomorph is presumed on the basis of association to be *Phacidium eucalypti* G.W.Beaton & Weste (1977) (Leotiales: Phacidiaceae).
Ceuthospora lauri (Grev.) Grev. **90**: 280.
Cladosporium sp. **64**: 305. A possible hyperparasite of *Vizella grevilleae.* See also **90**: 289.
Clavariopsis aquatica de Wild. **86**: 497.
Clypeococcum D.Hawks. (Dothideales) **91**: 462.
Clypeophysalospora H.J.Swart (Xylariales: Amphisphaeriaceae) **76**: 93.
Clypeophysalospora latitans (Sacc.) H.J.Swart **76**: 95. See also **78**: 259.
Coccodiella banksiae (Hansf.) H.J.Swart (Phyllachorales: Phyllachoraceae) **91**: 455.
Coccostroma Theiss. & Syd. = *Coccodiella* Hara.
Coccostroma banksiae Sivan. = *Coccodiella banksiae.*
Codinea assamica (Agnithothr.) S.Hughes & W.B.Kendr. **79**: 510
Codinea simplex S.Hughes & W.B.Kendr. **79**: 509
Colletogloeum acaciae (Cooke & Massee) B.C.Sutton & H.J.Swart **87**: 93.
Colletogloeum acaciicola B.C.Sutton & H.J.Swart **87**: 95.
Colletogloeum simmondsii B.C.Sutton & H.J.Swart **87**: 97.
Coma circularis (Cooke & Massee) Nag Raj & W.B.Kendr., **87**: 603. Teleomorph is *Ascocoma eucalypti.* Swart observed no spermatial state though Nag Raj & Kendrick (1972) had. See also **89**: 487.
Coniothyrium Corda **86**: 494; **90**: 289.
Coniothyrium ahmadii B.C.Sutton **86**: 494.
Coniothyrium eucalypticola B.C.Sutton **86**: 494.
Coniothyrium kallangurense B.C.Sutton & Alcorn **86**: 494.
Coniothyrium ovatum H.J.Swart **86**: 495.
Coniothyrium parvum H.J.Swart **86**: 495.
Cooksonomyces H.J.Swart & D.A.Griffiths **63**: 152.
Cooksonomyces banksiae H.J.Swart & D.A.Griffiths. **63**: 152. Includes a detailed study of conidium ultrastructure.
Coryneopsis Grove = *Sporocadus* vide Nag Raj (1993) and not *Seimatosporium* as proposed by Swart **90**: 633.
Corynespora acaciae H.J.Swart **84**: 175.
Coryneum Nees ex Schwein. **63**: 151; **87**: 93.
Coryneum acaciae McAlpine = *Colletogloeum acaciae.*
Coryneum cardinale W.W.Wagener = *Seiridium cardinale.*
Coryneum juniperinum Ellis & Everh. **61**: 80.
Coryneum umbonatum Nees ex Steud. **61**: 78.
Crandallia Ellis & Sacc. **87**: 99.
Cryptocoryneum Fuckel **63**: 151.
Cryptocoryneum banksiae. An unpublished Hansford manuscript name. **63**: 151.
Cryptostictis cupressi Guba = *Seiridium unicorne.*
Cryptostictis falcata B.C.Sutton = *Vermisporium falcatum.*
Cryptostictis grevilleae (Loos) Subram. & K.Ramakr. = *Sarcostroma grevilleae.*
Cryptostictis hakeae B.C.Sutton = *Sarcostroma hakeae.*
Cryptostictis hollowsii Tóth = *Seimatosporium hollowsii.*
Cryptostictis kennedyae (McAlpine) Subram. = *Sarcostroma kennedyae.*
Cryptostictis macalpinei Subram. & K.Ramakr. = *Sarcostroma kennedyae.*
Culicidospora R.H.Petersen **86**: 497.
Cyclodomus Höhn. **87**: 102.
Cylindrocarpon tonkinense Bugnic. **79**: 508.

Cylindrosporium Grev. **87**: 93.
Cylindrosporium acaciae Anahosur = *Colletogloeum acaciicola.*
Cylindrosporium acutum. = *Vermisporium acutum.* A McAlpine manuscript name. **78**: 269; **81**: 497.
Cylindrosporium eucalypti. Unpublished Hansford manuscript name for a hyperparasite on *Pachysacca samuelii.* **79**: 267; **81**: 501.
Cylindrosporium eucalypti McAlpine = *Vermisporium eucalypti.*
Cylindrosporium obtusum. An unpublished McAlpine manuscript name. **81**: 493.
Cylindrosporium samuelii Hansf. = *Vermisporium samuelii.*
Cytostagonospora martiniana (Sacc.) B.C.Sutton & H.J.Swart **87**: 99.
Dasyscyphus apala (Berk. & Broome) Dennis = *Lachnum apalum.*
Dasyscyphus macrolanceolatus G.W.Beaton = *Lachnum apalum* var. *beatonii.*
Davisoniella H.J.Swart **90**: 289.
Davisoniella eucalypti H.J.Swart **90**: 288.
Dendryphiella arenaria Nicot. **60**: 129.
Dichomera persooniae Henn. = *Camarosporula persooniae.*
Didymella Sacc ex D.Sacc. (Dothideales) **78**: 259.
Didymosphaeria banksiae Cooke & Massee = *Lineostroma banksiae.*
Diheterospora chlamydosporia (Goddard) G.L.Barron & Onions **79**: 508.
Dimerium banksiae (Sacc. & Bizz.) Petr. = *Episphaerella banksiae.*
Diploceras dilophosporum (Cooke) Sacc. **60**: 123. Anamorph of *Discostromopsis stoneae.* A form with wider conidia occurs on *Melaleuca decussata.* See also **59**: 311; **62**: 365; **73**: 213; **81**: 499; **84**: 174.
Diploceras discosioides (Ellis & Everh.) Nag Raj. **61**: 78.
Diploceras elegans (H.J.Swart) Nag Raj. **73**: 213. Presumed teleomorph is *Discostromopsis elegans.* Nag Raj (1993) reported the conidia to be much longer than given in Swart's description.
Diploceras hypericinnum (Ces.) Died. **78**: 268.
Diploceras kriegerianum (Bres.) Nag Raj. **73**: 213. Presumed anamorph of *Discostromopsis callistemonis.*
Diploceras leptospermi (R.G.Bagn. & Sheridan) Nag Raj. **72**: 409; **73**: 214; **81**: 491. Presumed anamorph of *Discostromopsis leptospermi.*
Diploceras mnehlenbeckiae (McAlpine) Nag Raj. **72**: 407.
Discostroma Clem. (Xylariales: Amphisphacriaceae) **72**: 409. The genus *Discostroma* has been revised by Brockmann (1977) and Barr (1990, 1994). Anamorphs are species of *Seimatosporium sensu stricto*, and *Sporocadus.*
Discostromopsis H.J.Swart (Xylariales: Amphisphaeriaceae) **73**: 217. Eriksson & Hawksworth (1993) consider *Discostromopsis* to be a later synonym of *Discostroma.* However, Nag Raj (1993) has maintained *Discostromopsis* as a distinct genus with a distinctive anamorph, *Diploceras.*
Discostromopsis callistemonis H.J.Swart **73**: 217. Presumed teleomorph of *Diploceras kriegerianum.*
Discostromopsis elegans H.J.Swart **73**: 217. Teleomorph of *Diploceras elegans.*
Discostromopsis leptospermi H.J.Swart **73**: 218. Teleomorph of *Diploceras leptospermi.*
Discostromopsis stoneae H.J.Swart **73**: 217. Teleomorph of *Diploceras dilophosporum.* See also **84**: 174.
Dothidasteroma casuarinae H.J.Swart (Dothideales: Parmulariaceae) **91**: 582.
Dothidasteromella evanescens (Rehm) Arx (Dothideales: Asterinaceae) **91**: 460.
Dothidasteromella sepulta (Berk. & Curtis) Höhn. **91**: 460.
Dothidasteromella systema-solare (Massee) H.J.Swart **53**: 322; **91**: 459.
Dothidella evanescens Rehm = *Dothidasteromella evanescens.*
Dothidella inaequalis Cooke = *Rehmiodothis inaequalis.*
Dothiora schizospora Luttr. (Dothideales: Dothioraceae) **91**: 456.
Entopeltidaceae Arx & E. Müll. **57**: 456. Invalid name because published without a Latin description.

Entopeltis Höhn.. **57**: 456. Swart considered this genus to be a synonym of *Vizella*.
Epipolaeum banksiae (Sacc. & Bizz.) Arx = *Episphaerella banksiae*.
Episphaerella banksiae (Sacc. & Bizz.) H.J.Swart (Dothideales: Dimeriaceae) **91**: 453.
Eudarluca Speg. (Dothideales: Phaeosphaeriaceae) **90**: 287.
Eupenicillium baarnense (T.H.Beyma) Stolk & D.B.Scott (Eurotiales: Trichocomaceae) **55**: 310.
Eupenicillium katangense Stolk **55**: 310.
Fairmaniella leprosa (Fairm.) Petr. & Syd. **90**: 280.
Flabellospora Alas. **86**: 497.
Fusarium solani (Martius) Sacc. **64**: 513.
Gaubaea Petr. **87**: 99.
Gelineostroma H.J.Swart (Rhytismatales) **90**: 445. There is uncertainty as to which family this genus should be placed.
Gelineostroma athrotaxi H.J.Swart **90**: 445.
Geniculospora sp. **86**: 497.
Geotrichum candidum Link **79**: 508.
Gliocladium roseum Bainier **79**: 508.
Gloeosporiella eucalypti Hansf. = *Coma circularis*.
Harknessia eucalypti Cooke. **59**: 311. Conidia from *Leptospermum myrsinoides* were smaller than reported previously. An evanescent mucilaginous sheath was not observed. Occurs also on non-myrtyaceous hosts (Sutton & Pascoe 1989).
Harknessia renispora H.J.Swart. **59**: 309. Occurs also on non-myrtaceous hosts (Sutton & Pascoe 1989).
Harknessia uromycoides (Speg.) Speg. **59**: 311. On non-myrtaceous hosts too (Sutton & Pascoe 1989).
Helicodendron triglitziense (Jaap) Linder **86**: 497.
Helicomyces sp. **86**: 497.
Heliscus lugdunensis Sacc. & Therry **86**: 497.
Heliscus sp. **86**: 497.
Hendersonia Berk. **86**: 495; **87**: 95; **90**: 633. *Hendersonia* is a *nomen rejiciendum* for *Stagonospora*.
Hendersonia acaciae Gonz. Frag. **87**: 93.
Hendersonia canberrica Petr. = *Colletogloeum acaciae*.
Hendersonia corynoidea Cooke & Harkn. **90**: 633.
Hendersonia eucalypti Cooke & Harkn. = *Sporocadus lichenicola*.
Hendersonia eucalypticola A.R.Davis = *Sonderhenia eucalypticola*.
Hendersonia eucalyptina A.C.Santos **90**: 633.
Hendersonia eucalyptorum Hansf. = *Sonderhenia eucalyptorum*.
Hendersonia fraserae Hansf. = *Sonderhenia eucalypticola*.
Hendersonia grandispora McAlpine = *Kirramyces epicoccoides*.
Hendersonia persooniae Henn. = *Camarosporula persooniae*.
Hendersonia phyllodiorum Sydow **87**: 93.
Humicola fuscoatra Traaen **79**: 507.
Humicola grisea Traaen **79**: 508.
Hymenopleella Munk **61**: 73. A synonym of *Lepteutypa* vide Barr (1994).
Hypodermellina Höhn. (Rhytismatales) **90**: 445.
Hysterostomella filicina (Berk. & Broome) Höhn. Misidentification of *Rhagadolobium dicksoniifolium*. **91:** 581.
Idiocercus australis (Cooke) H.J.Swart **90**: 283. Nag Raj (1993) excluded this taxon from *Idiocercus* but did not transfer the species to another genus.
Janetia capnophila S.Hughes **84**: 175.
Janetia interna H.J.Swart **84**: 174. A mycoparasite?
Jubispora B.C.Sutton & H.J.Swart **87**: 97.
Jubispora acaciae B.C.Sutton & H.J.Swart **87**: 99.
Kirramyces epicoccoides (Cooke & Massee) J.Walker, B.C.Sutton & Pascoe **90**: 640. See Walker *et al.* (1992) for a discussion of the genus *Kirramyces*.
Kirramyces eucalypti (Cooke & Massee) J.Walker, B.C.Sutton & Pascoe **90**: 640. See

also Walker *et al.* (1992).
Labridella Brenckle **63**: 172.
Lachnum apalum (Berk. & Broome) Nannf. (Leotiales: Hyaloscyphaceae) **80**: 550.
Lachnum apalum (Berk. & Broome) Nannf. var. ***beatonii*** Spooner **80**: 550. See also Spooner (1987).
Laestadia eucalypti Rolland = *Clypeophysalospora latitans.*
Laestadia eucalypti Speg. = *Clypeophysalospora latitans.*
Laestadia rollandi Sacc. & Syd. = *Clypeophysalospora latitans.*
Lauterbachiella dicksoniifolia Dingley = *Rhagadolobium dicksoniifolium.*
Lembosia eucalypti F.L.Stevens & Dixon-Stew. = *Aulographina eucalypti.*
Lembosina persooniae H.J.Swart (Dothideales: Asterinaceae) **58**: 420.
Lembosiopsis eucalyptina Petr. & Syd. = *Aulographina eucalypti.*
Lepteutypa Petr. (Xylariales: Amphisphaeriaceae) **72**: 409; **73**: 220.
Lepteutypa cupressi (Nattrass, C.Booth & B.C.Sutton) H.J.Swart (Xylarialaes: Amphisphaeriaceae) **61**: 79; **81**: 495. Besides a *Seiridium* anamorph (*S. unicorne*) Swart also reported a spermatial state. See **74**: 289 for details of conidial wall structure. There is still no confirmed record of this species from North America (Barr, 1994).
Lepteutypa hippophaës (Fabre) Arx **61**: 73.
Leptosphaeria sp. **61**: 78.
Leptosphaeria hippophaës (Sollm.) Sacc. = *Lepteutypa hippophaës.*
Leptostromella (Sacc.) Sacc. **87**: 97.
Leptostromella acaciae Syd. & P.Syd. = *Colletogloeum acaciicola.*
Leptostromella eucalypti Cooke & Massee = *Thyrinula eucalypti.*
Lineostroma H.J.Swart **91**: 464.
Lineostroma banksiae (Cooke) H.J.Swart **91**: 460. A spermatial state was reported but not named.
Lunulospora curvula Ingold **86**: 497.
Macrohilum H.J.Swart **90**: 287.
Macrohilum eucalypti H.J.Swart **90**: 287.
Malbranchea sp. **79**: 508.
Manginula Arnaud. **57**: 455. An anamorph of *Vizella* **64**: 301.
Mariannaea elegans (Corda) Samson var. *punicea* Samson **79**: 508.
Marssonia acaciae Cooke & Massee = *Colletogloeum acaciae.*
Marssonia Fischer **87**: 95.
Marssonia Karst. **87**: 95.
Melanconium eucalypticola Hansf. = *Fairmaniella leprosa.*
Melanomma hippophaës Fabre **61**: 73.
Melasmia Lév. **87**: 99.
Metarhizium anisopliae (Metschn..) Sorokin **79**: 508.
Metarhizium brunneum Petch **79**: 508.
Microsphaeropsis Höhn. **85**: 494.
Microthyrium amygdalinum Cooke & Massee = *Phaeothyriolum microthyrioides.*
Microthyrium eucalypti Henn. **87**: 81. Swart (**87**: 611) suggests this taxon is a synonym of *Phaeothyriolum microthyrioides.*
Microthyrium eucalypticola Speg. (Dothidiales: Microthyriaceae) **87**: 88. Perhaps a species of *Arnaudiella* according to Swart.
Monochaetia lomatiae McAlpine apud Hansf. = *Sarcostroma lomatiae.*
Monochaetia lutea H.J.Swart & D.A.Griffiths **62**:152. See also **62**: 365; **74**: 295.
Monochaetia monochaetia (Desm.) Sacc. **62**: 151; **74**: 289.
Monochaetia muehlenbeckiae McAlpine apud Hansf. = *Diploceras muehlenbeckiae.*
Monochaetia unicornis (Cooke & Ellis) Sacc. = *Seiridium unicorne.*
Montagnella eucalypti Cooke & Massee = *Rehmiodothis eucalypti.*
Montagnella rugulosa Cooke **87**: 609. Swart considered this a *nomen dubium* **89**: 487.
Mucor circinelloides Tiegh. **79**: 508.
Mucor hiemalis Wehmer. **64**: 511.
Mucor plumbeus Bonard. **79**: 508.
Mucor recurvus E. E. Butler **64**: 514.

Mycomicrothelia eucalyptina (Syd.) E. Müll. = *Phaeothyriolum microthyrioides*.
Mycosphaerella Johanson (Dothideales: Mycosphaerellaceae) **58**: 417; **65**: 88.
Mycosphaerella mycoparasitica H.J.Swart **65**: 88. Mycoparasitic on *Thallomycetis oritidis* on *Orites lancifolia* foliage. The pycnidial spermatial state was not identified. See also **90**: 287.
Mycosphaerellaceae **58**: 417; **78**: 259.
Ophiobolus Riess (Dothideales: Leptosphaeriaceae) **91**: 456.
Ophiodothella atromaculans (Henn.) Höhn. **79**: 566.
Ophiodothella longispora H.J.Swart (Phyllachorales: Phyllachoraceae) **79**: 567. See also **85**: 554.; **90**: 280.
Ophiodothis atromaculans Henn. **79**: 566.
Pachysacca Syd. (Dothideales: Dothideaceae) **79**: 261; **79**: 566. See also **87**: 609.
Pachysacca eucalypti Syd. **79**: 261. The phialidic spermatial state was illustrated but not named. The putative conidial state, *Phomachora eucalypti* Syd. was not observed in any collection. Swart mentions a pycnidial hyperparasitic fungus in one collection. See also **64**: 305.
Pachysacca pusilla H.J.Swart. **79**: 268. No spermatial state was reported.
Pachysacca samuelii (Hansf.) H.J.Swart **79**: 267. A phialidic spermatial state was reported but not named; hyperparasites frequently present.
Paecilomyces farinosus (Holmsk.) A.H.S.Br. & G.Sm. **79:** 508.
Paecilomyces lilacinus (Thom) Samson **79**: 508.
Parodiella banksiae Sacc. & Bizz. = *Episphaerella banksiae*.
Penicillium aurantiogriseum Dierckx **79**: 508.
Penicillium citreonigrum Dierckx **79**: 508.
Penicillium dimorphosporium H.J.Swart **55**: 310. Pitt (1979) placed this species in *Penicillium* subgenus *Aspergilloides* Dierckx.
Penicillium expansum Link **79**: 508.
Penicillium restrictum J.C.Gilman & E.V.Abbott **55**: 312.
Penicillium verrucosum Dierckx var. *cyclopium* (Westling) Samson, Stolk & Hadlok = *Penicillium aurantiogriseum*.
Pestalotia De Notaris **60**: 123; **61**: 79; **62**: 152; **62**: 295; **63**: 169; **74**: 289. At present *Pestalotia* is a monotypic genus (Nag Raj 1993). The teleomorph is not known.
Pestalotia funerea Desm. = *Pestalotiopsis funerea*.
Pestalotia pezizoides de Not. **63**: 169; **62**: 302. The ultrastructure of the conidia is described.
Pestalotiopsis Steyaert **62**: 159; **62**: 295; **63**: 153; **63**: 169; **73**: 220; **74**: 289. A very large genus with species separated on the basis of host and small morphological differences. Teleomorphs in *Pestalosphaeria* Barr and *Broomella*.
Pestalotiopsis funerea (Desm.) Steyaert **61**: 80, **62**: 296.
Pestalotiopsis monochaetoides (Doyer) Steyaert **62**: 302.
Pestalotiopsis triseta (Moreau & Mme J.Moreau) Steyaert **62**: 296.
Pestalozziella circularis Cooke & Massee = *Coma circularis*.
Phaeoseptoria Speg. **90**: 640. See also Walker *et al.* (1992).
Phaeoseptoria eucalypti Hansf. = *Kirramyces epicoccoides*.
Phaeoseptoria papayae Speg. **90**: 640. See also Walker *et al.* (1992).
Phaeothyriolum eucalyptinum Syd. = *Phaeothyriolum microthyrioides*.
Phaeothyriolum microthyrioides (G.Winter) H.J.Swart (Dothideales: Microthyriaceae) **87**: 81. See also **87**: 603; **90**: 287.
Phialocephala sp. **79**: 508.
Phloeospora Wallr. **87**: 93.
Phoma australis Cooke = *Idiocercus australis*.
Phomachora eucalypti Syd. **79**: 263. The putative conidial state of *Pachysacca eucalypti* though Swart thought this unlikely.
Phycomyces blakesleeanus Burgeff **64**: 513.
Phyllachora Nitschke ex Fuckel (Phyllachorales; Phyllachoraceae) **61**: 73; **79**: 566; **85**: 552; **87**: 81; **89**: 483; **91**: 458.
Phyllachora (Montagnella) eucalypti Cooke & Massee = *Rehmiodothis eucalypti*.

Phyllachora eucalypti (Cooke & Massee) Theiss. & Syd. = *Plectosphaera eucalypti*.
Phyllachora eucalypti (Speg.) Petr. = *Clypeophysalospora latitans*.
Phyllachora ficuum Niessl **85**: 553.
Phyllachora (Dothidella) inaequalis Cooke **81**: 497.
Phyllachora maculata Cooke = *Plectosphaera eucalypti*.
Phyllachora punctum (Schwein.) Orton. **79**: 566.
Physalospora Niessl (Hypocreaceae) **76**: 91.
Physalospora eucalypti (Rolland) Schrantz = *Clypeophysalospora latitans*.
Physalospora eucalypti Narendra & V. G. Rao **76**: 95. Described from India (Narendra & Rao, 1977).
Physalospora latitans Sacc. = *Clypeophysalospora latitans*.
Physosporella eucalypti (Speg.) Höhn. = *Clypeophysalospora latitans*.
Placoasterella baileyi (Berk. & Broome) Arx (Dothideales: Asterinaceae) **51**: 148. Swart also gives a preliminary account of an unidentified hyperparasitic fungus.
Placostroma inaequalis (Cooke) Theiss. & Syd. = *Rehmiodothis inaequalis*.
Plectosphaera Theiss. (Phyllachorales: Phyllachoraceae). A synonym of *Phyllachora* according to Eriksson & Hawksworth (1993).
Plectosphaera banksiae H.J.Swart **91**: 457.
Plectosphaera eucalypti (Cooke & Massee) H.J.Swart **76**: 91. Swart described but did not name the conidial state. See also **79**: 566; **85**: 554. Pascoe (1990) published detailed studies of the ascus structure. He found the asci were bitunicate with an annellate apical apparatus different to that of the Australian species of *Phyllachora* examined. Fissitunicate discharge of the ascus was demonstrated.
Plectosphaera eucalypti (Cooke & Massee) Theiss. & Syd. **85**: 554. This seems to be an error by Swart in citation of authors. Bettucci & Saravay (1993) reported *Plectosphaera eucalypti* Theiss. to be a common endophyte in *Eucalyptus globulus* in Uruguay. We have not been able to locate the place of publication of this binomial.
Pleospora Rabenh. ex Ces. & De Not. (Dothideales: Pleosporaceae) **78**: 259.
Polystigmataceae Höhn. ex Nannf. = Phyllachoraceae.
Prillieuxina systema-solare (Massee) M.H.Ryan = *Dothidasteromella systema-solare*.
Pseudohelotium asperotrichum Beaton (Leotiales: Hyaloscyphaceae) **80**: 549.
Pseudohelotium juncicola Dennis = *Asperopilum juncicola*.
Pseudopeziza eucalypti Hansf. = *Ascocoma eucalypti*.
Pseudosphaeria samuelii Hansf. = *Pachysacca samuelii*
Rehmiodothis eucalypti (Cooke & Massee) H.J.Swart (Phyllachorales: Phyllachoraceae) **87**: 609; **89**: 483. Kutumoto (1991) gave a detailed description of *R. osbeckiae* (Berk. & Broome) Theiss. & Syd. the type species of the genus. Katumoto considered *Rehmiodothis* to be a monotypic genus.
Rehmiodothis inaequalis (Cooke) H.J.Swart **89**: 483.
Rhagadolobium dicksoniifolium (Dingley) Arx & E.Müll. (Dothideales: Parmulariaceae) **91**: 581.
Rhizoctonia solani Kuhn **64**: 514.
Rhizopus stolonifer (Ehrenberg:Fr.) Lind **64**: 514.
Rhopographus Nitschke ex Fuckel (Dothideales) **87**: 608.
Rhynchosphaeria cupressi Nattrass, C. Booth & B.C.Sutton = *Lepteutypa cupressi*.
Rhytisma eucalypti Henn. **87**: 611. Swart suggests this might be a species of *Ascocoma*.
Rosencheldiella oleariae H.J.Swart (Dothideales; Venturiaceae) **58**: 417.
Sarcostroma acaciae Nag Raj **62**: 151; **72**: 407 (as *Seimatosporium arbuti*).
Sarcostroma arbuti (Bonar) Nag Raj **62**: 151.
Sarcostroma brevilatum (H.J.Swart & D.A.Griffiths) Nag Raj **62**: 360; **78**: 265.
Sarcostroma cadicola (B.C.Sutton) Nag Raj **62**: 151; **72**: 407.
Sarcostroma daviesiae (McAlpine) Nag Raj **72**: 406.
Sarcostroma grevilleae (Loos) Nag Raj **60**: 124; **62**: 159; **62**: 365; **72**: 403. According to Nag Raj (1993) this may be a complex of two or more species.
Sarcostroma hakae (B.C.Sutton) Nag Raj **72**: 403. Swart considered this species to be conspecific with *Sarcostroma kennedyae*.

Sarcostroma kennedyae (McAlpine) Nag Raj **72**: 403; **59**: 311. The collection on *Platylobium* reported by Swart needs to be re-examined in view of changed species concepts.

Sarcostroma leucopogonis (H.J.Swart) Nag Raj **72**: 409.

Sarcostroma lomatiae (McAlpine) Nag Raj **72**: 403. Swart briefly described a possible teleomorph (**72**: 409) that seemed to belong to an undescribed genus. At present no teleomorph has been described for any species of *Sarcostroma* (Nag Raj 1993).

Sarcostroma mariae (Clinton) Nag Raj **72**: 408.

Schizothyrium sp. (Dothideales: Schizothyriaceae) **87**: 90.

Scirrhia Nitschke ex Fuckel (Dothideales: Dothideaceae) **91**: 462.

Scolecodothis hypophylla (Theiss.) Theiss. & Syd. (Phyllachorales: Phyllachoraceae) **79**: 566. According to Eriksson & Hawksworth (1993) *Scolecodothis* is a synonym of *Ophiodothella* (Henn.) Höhn.

Seimatosporium Corda **62**: 152; **62**: 295; **63**: 153; **63**: 169; **72**: 403; **81**: 491. Nag Raj (1993) concluded that *Seimatosporium sensu lato* was not monophyletic and segregated the taxa into five genera. The teleomorph of *Seimatosporium sensu stricto* is *Discostroma*.

Seimatosporium arbuti (Bonar) Shoemaker = *Sarcostroma arbuti*. See also **72**: 407.

Seimatosporium arbuti (Bonar) Shoemaker *sensu* H.J.Swart **62**: 151 = *Sarcostroma acaciae*.

Seimatosporium brevilatum H.J.Swart & D.A.Griffiths = *Sarcostroma brevilatum*.

Seimatosporium cadicola (Sutton) Shoemaker = *Sarcostroma cadicola*.

Seimatosporium cylindrosporum H.J.Swart = *Vermisporium cylindrosporium*.

Seimatosporium daviesiae (McAlpine) Shoemaker = *Sarcostroma daviesiae*.

Seimatosporium dilophosporum (Cooke) B.C.Sutton = *Diploceras dilophosporum*.

Seimatosporium discsioides (Ellis & Everh.) Shoemaker = *Diploceras discosioides*.

Seimatosporium elegans H.J.Swart = *Diploceras elegans*.

Seimatosporium eucalypti (McAlpine) H.J.Swart = *Vermisporium eucalypti*.

Seimatosporium falcatum (B.C.Sutton) Shoemaker = *Vermisporium falcatum*.

Seimatosporium fusisporum H.J.Swart & D.A.Griffiths = *Sarcostroma brevilatum*.

Seimatosporium grevilleae (Loos) Shoemaker = *Sarcostroma grevilleae*.

Seimatosporium hakeae (B.C.Sutton) Shoemaker = *Sarcostroma hakae*.

Seimatosporium hollowsii (Toth) Shoemaker is not conspecific with *Seimatosporium kennedyae* as proposed by Swart (**72**: 403) and may be a species of *Sarcostroma* according to Nag Raj (1993).

Seimatosporium hypericinum (Ces.) B.C.Sutton = *Diploceras hypericinum*.

Seimatosporium lysterioides (Fuckel) Brockmann **72**: 407.

Seimatosporium kennedyae (McAlpine) Shoemaker = *Sarcostroma kennedyae*.

Seimatosporium kriegerianum (Bres.) Morgan-Jones & B.C.Sutton apud B.C.Sutton = *Diploceras kriegerianum*.

Seimatosporium leptospermi Bagnall & Sheridan = *Diploceras leptospermi*.

Seimatosporium leucopogonis H.J.Swart = *Sarcostroma leucopogonis*.

Seimatosporium lichenicola (Corda) Shoemaker & E. Müll. = *Sporocadus lichenicola*.

Seimatosporium mariae (Clinton) Shoemaker = *Sarcostroma mariae*.

Seimatosporium muehlenbeckiae (McAlpine apud Hansf.) H.J.Swart = *Diploceras muehlenbeckiae*.

Seimatosporium rosae Corda **78**: 265.

Seimatosporium samuelii (Hansf.) J. Walker & H.J.Swart = *Vermisporium samuelii*.

Seiridium Nees:Fr. **61**: 71; **62**: 152; **74**: 289. Anamorphs of species of *Lepteutypa* and *Blogiascospora* Shoemaker, E.Müll. & Morgan-Jones. One species known from *Eucalyptus* (Nag Raj 1993).

Seiridium cardinale (W. W. Wagener) B.C.Sutton & I.A.S.Gibson **61**: 78.

Seiridium unicorne (Cooke & Ellis) B.C.Sutton **61**: 78. Teleomorph *Lepteutypa cupressi*. See **74**: 289 for details of conidium wall structure. Nag Raj (1993) considered *Seiridium cupressi* (Guba) Boesewinkel, which has been reported from Australasia (Boesewinkel 1983), to be conspecific with *S. unicorne*.

Semifissispora H.J.Swart (Dothideales) **78**: 259. The family placement is uncertain.

Semifissispora elongata H.J.Swart **78**: 260. An unidentified hypersaprophytic ascomycete was also present in the collections examined and was figured by Swart.
Semifissispora fusiformis H.J.Swart **78**: 259. Cultures from the type collection yielded a fungus forming phialospores in pycnidia; Swart did not identify it.
Semifissispora rotundata H.J.Swart **78**: 259.
Septogloeum Sacc. **87**: 93.
Septogloeum acaciae Syd. = *Colletogloeum acaciicola.*
Septogloeum acaciae Verwoerd & du Plessis = *Jubispora acaciae.*
Septoria acaciae Neerg. **87**: 93 .
Septoria cytisi Desm. **87**: 102.
Septoria martiniana Sacc. = *Cytostagonospora martiniana.*
Septoria phyllodiorum Cooke & Massee = *Cytostagonospora martiniana.*
Septoria phyllodiorum Sacc. **87**: 93.
Septoria pulcherrima Gadgil & M.Dick = *Kirramyces eucalypti.*
Septoriella Oudem. **87**: 99.
Seynesia banksiae Henn. = *Dothidasteromella systema-solare.*
Seynesia microthyrioides (Winter) Theiss. = *Phaeothyriolum microthyrioides.*
Seynesiella G.Arnaud (Dothideales: Microthyriaceae) **87**: 87.
Sirosporium Bubák & Serebrian. **51**: 150.
Sonderhenia H.J.Swart & J. Walker **90**: 640.
Sonderhenia eucalypticola (A.R.Davis) H.J.Swart & J.Walker **90**: 640.
Sonderhenia eucalyptorum (Hansf.) H.J.Swart & J.Walker **90**: 640.
Sordaria humana (Fuckel) Winter **79**: 508.
Sphaeria hippophaës Sollm. **61**: 73.
Spilomyces dendriticus Hansf. **79**: 264.
Sporocadus Corda **72**: 407.
Sporocadus lichenicola Corda **61**: 78; **72**: 407; **90**: 633. Teleomorph *Discostroma corticola.*
Stagonospora (Sacc.) Sacc. **87**: 95; **90**: 633.
Stagonospora acaciae Hansf. **87**: 93.
Stagonospora delegatensis Park & Keane **90**: 284. Pycnidial anamorph of *Mycosphaerella delegatensis* R.F.Park & Keane. Walker *et al.* (1992) considered *S. delegatensis* not to be a species of *Stagonospora* but did not transfer it to *Kirramyces* where it would appear more appropriately placed.
Stagonospora orbicularis Cooke = *Vermisporium orbiculare.*
Stagonospora pulcherrima (Gadgil & M.Dick) H.J.Swart = *Kirramyces eucalypti.*
Staninwardia B.C.Sutton **90**: 289.
Stigmatea conferta (Fr.) Fr. **65**: 84.
Stigmatea oritidis Hansf. = *Thallomyces oritidis.*
Stigmina Sacc. **63**: 152.
Stilbospora foliorum Cooke **90**: 279.
Synpodiocladium frondosum Descals **86**: 497.
Syncephalastrum sp. **64**: 514.
Teratosphaeria Syd. & P.Syd. (Dothideales: Phaeosphacriaceae) **91**: 464.
Tetracladium marchalianum De Wild. **86**: 497.
Tetracladium setigerum (Grove) Ingold **86**: 497.
Thallochaete baileyi (Berk. & Broome) Hansf. = *Placoasterella baileyi.*
Thallomyces H.J.Swart (Dothideales: Parmulariaceae) **65**: 84.
Thallomyces oritidis (Hansf.) H.J.Swart **65**: 85.
Thoracella Oudem. **87**: 99.
Thyrinula eucalypti (Cooke & Massee) H.J.Swart **90**: 286. Anamorph of *Aulographina eucalypti.*
Thyrinula eucalyptina Petrak & Sydow = *Thyrinula eucalypti.*
Toxosporiopsis B.C.Sutton & Sellars **90**: 279.
Trabutia eucalypti Cooke & Massee = *Plectosphaera eucalypti.*
Trichocladium asperum Harz **79**: 509.

Trichoderma koningii Oudem. **79**: 508.
Trichoderma viride Pers. ex Fr. **79**: 508.
Trichosporon sp. **79**: 508.
Tricladium attenuatum S. H. Iqbal **86**: 497.
Tricladium patulum Marvanová & Marvan **86**: 497.
Tricladium splendens Ingold **86**: 497.
Tricladium terrestre D.Park **86**: 497.
Tricladium sp. **86**: 497.
Triscelophorus acuminatus Nawawi **86**: 497.
Triscelophorus monosporus Ingold **86**: 497.
Triscelophorus sp. **86**: 497.
Troposporella fumosa P.Karst. **86**: 497.
Truncatella Steyaert **62**: 152; **62**: 302; **73**:220.
Uromycladium simplex McAlpine (Uredinales) **62**: 151.
Verruisporium H.J.Swart & M.A.Will. **81**: 491.
Verruisporium acutum H.J.Swart & M.A.Will. **81**: 495. Spermatia present.
Verruisporium biseptatum H.J.Swart & M.A.Will. **81**: 492.
Verruisporium brevicentrum H.J.Swart & M.A.Will. **81**: 493.
Verruisporium cylindrosporum (H.J.Swart) Nag Raj **78**: 267; **81**: 491.
Vermisporium eucalypti (McAlpine) Nag Raj **78**: 267; **81**: 491.
Verruisporium falcatum (B.C.Sutton) Nag Raj **78**: 265; **62**: 359.
Verruisporium obtusum H.J.Swart & M.A.Will. **81**: 499. 'May be a complex of species'.
Verruisporium orbiculare (Cooke) H.J.Swart & M.A.Will. **81**: 497; **78**: 268.
Verruisporium sanuelii (Hansf.) J.A.Simpson & Grgurin. *comb. nov.*
Basionym: *Cylindrosporium sanuelii* Hansf. in *Proceedings of the Linnaean Society of New South Wales* **81**: 46, 1956. *Specimen examined*: ADW 3840, on *Eucalyptus* sp., Pinnaroo, Sept. 1924 , G. Samuel. **90**: 287.
Verruisporium walkeri H.J.Swart & M.A.Will. **81**: 495. Spermatia on sympodially proliferating conidiophores also present. See also **87**: 609; **89**: 487.
Vermisporium sp. **81**: 498. Perhaps a new species.
Verticillium alboatrum Reinke & Berthold **64**: 514.
Verticillium dahliae Kleb. **64**: 513.
Verticillium psalliotae Treschow **64**: 514.
Verticillium spp. **79**: 509.
Vizella Sacc. (Dothideales: Vizellaceae) **57**: 455; **64**: 301; **65**: 83.
Vizella bauksiae H.J.Swart **57**: 458; **64**: 301.With unnamed conidial and spermatial states.
Vizella bingervilliana C.Moreau & M.Moreau **57**: 462.
Vizella grevilleae H.J.Swart **64**: 303. Unnamed conidial and spermatial states also present.
Vizella hendrickxii (Hansf.) S.Hughes **57**: 455. **64**: 306.
Vizella interrupta (Winter) S.Hughes **57**: 457.
Vizella memorabilis (Dilcher) Selkirk **64**: 301.
Vizella oleariae H.J.Swart. **57**: 462. Swart did not provide names for either the conidial or spermatial states; he indicated that *Manginula* might be an anamorph genus of *Vizella*.
Vizella pycnanthae Sivan. **64**: 301.
Vizellaceae H.J.Swart. **57**: 456. A family in the Dothideales.
Westea H.J.Swart (Dothideales) **91**: 456. The family in which this genus should be placed is still to be decided (Eriksson & Hawksworth 1993).
Westea banksiae H.J.Swart **91**: 455.
Wettsteinina Höhn. **79**: 266.

Hosts

Acacia arabica (Lam.) Willd.
Colletogloeum acaciicola
Acacia armata R. Br.
Septoria acaciae
Acacia catechu (L.f.) Willd.
Colletogloeum acaciifolia
Acacia complanata Benth.
Colletogloeum sinumondsii
Acacia elata Benth.
Stagonospora acaciae
Acacia glandiifornis Benth.
Hendersonia phyllodiorum
Acacia longifolia (Andrews) Willd.
Cytostagonospora martiniana
Acacia melanoxylon R.Br. (as *A. melanopsilon)*
Hendersonia acaciae
Acacia obliquinervia Tindale
Corynespora acaciae
Acacia penninervis DC.
Colletogloeum acaciae
Acacia pycnatha Benth.
Colletogloeum acaciae
Corynespora acaciae
Monochaetia lutea
Sarcostroma acaciae
Uromycladium simplex
Acacia relmanniana Schinz
Colletogloeum acaciicola
Acacia tortilis (Forssk.) Hayne
Jubispora acaciae
Acacia tortilis subsp. *spirocarpa* (Hochst. ex A.Rich.) Brenan
Jubispora acaciae
Acrotriche sp.
Sarcostroma cadicola
Allocasuarina luehmannii (R.T.Baker) L.A.S.Johnson
Dothidasteroma casuarinae
Angophora sp.
Phaeothyriolum microthyrioides
Athrotaxis cupressoides D.Don
Apiothyrium tasmanicum
Gelineostroma athrotaxi
Athrotaxis selaginoides D.Don
Gelineostroma athrotaxi
Banksia integrifolia L. f.
Lineostroma banksiae
Plectosphaera banksiae
Vizella banksiae
Westea banksiae
Banksia marginata Cav.
Coccodiella banksiae
Cooksonomyces banksiae
Dothidasteromella systema-solare
Episphaerella banksiae
Lineostroma banksiae
Banksia robur Cav.
Dothidasteromella systema-solare
Banksia serrata L. f.
Lineostroma banksiae
Banksia spinulosa Sm.
Cooksonomyces banksiae
Brachypodium sylvaticum (Huds.) P.Beauv.
Pestalotiopsis triseta
Callistemon citrinus (Curtis) Stapf
Diploceras dilophosporum
Diploceras kriegerianum
Vermisporium sp.
Callistemon macropunctatus (Dum. Cours.) Court
Diploceras dilophosporum
Callistemon pallidus (Bonpl.) DC
Diploceras dilophosporum (Cooke) B.C.Sutton
Callistemon sieberi DC
Diploceras kriegerianum
Correa reflexa (Labill.) Vent.
Sarcostroma mariae
Cupressus macrocarpa Hartw.
Lepteutypa cupressi
Pestalotiopsis funerea
Seiridium unicorne
Daviesia latifolia R. Br.
Sarcostroma daviesiae
Dicksonia antarctica Labill.
Rhagadolobium dicksoniifolium
Eucalyptus amygdalina Labill.
Phaeothyriolum microthyrioides
Vermisporium obtusum
Eucalyptus baxteri (Benth.) J.M.Black
Vermisporium biseptatum
Vermisporium obtusum
Vermisporium walkeri
Eucalyptus behriana F.Muell.
Clypeophysalospora latitans
Semifissispora fusiformis
Vermisporium cylindrosporium
Eucalyptus botryoides Sm.
Phaeothyriolum microthyrioides
Vermisporium sp.
Eucalyptus camaldulensis Dehnh.
Pachysacca eucalypti
Pachysacca samuelii
Semifissispora rotundata
Vermisporium biseptatum
Eucalyptus cephalocarpa Blakely
Pachysacca samuelii
Eucalyptus creba F.Muell.
Vermisporium falcatum
Eucalyptus delegatensis R.T.Baker
Phaeothyriolum microthyrioides

Schizothyrium sp.
Stagonospora delegatensis
Vermisporium falcatum
Vermisporium obtusum
Eucalyptus diversifolia Bonpl.
Pachysacca eucalypti
Phaeothyriolum microthyrioides
Vermisporium cylindrosporum
Eucalyptus dives Schauer
Coniothyrium ovatum
Schizothyrium sp.
Vermisporium falcatum
Eucalyptus dumosa Oxley
Vermisporium brevicentrum
Eucalyptus elata Dehnh.
Phaeothyriolum microthyrioides
Eucalyptus eximia Schauer
Phaeothyriolum microthyrioides
Eucalyptus fasciculosa F.Muell.
Fairmaniella leprosa
Eucalyptus foecunda Schauer
Vermisporium biseptatum
Eucalyptus globulus Labill.
Clypeophysalospora latitans
Hendersonia corynoidea
Phaeothyriolum microthyrioides
Physalospora eucalypti
Sarcostroma brevilatum
Sonderhenia eucalypticola
Sporocadus lichenicola
Vermisporium bisetatum
Eucalyptus goniocalyx Miq.
Ophiodothella longispora
Pachysacca samuelii
Plectosphaera eucalypti
Eucalyptus gracilis F.Muell.
Idiocercus australis
Eucalyptus leucoxylon F.Muell.
Sonderhenia eucalyptorum
Eucalyptus macrorhyncha Benth.
Coniothyrium ovatum
Vermisporium biseptatum
Vermisporium obtusum
Vermisporium orbiculare
Vermisporium walkeri
Eucalyptus mannifera Mudie
Plectosphaera eucalypti
Eucalyptus marginata Smith
Davisoniella eucalypti
Eucalyptus melliodora Schauer
Coniothyrium parvum
Plectosphaera eucalypti
Vermisporium biseptatum
Eucalyptus nitens (H.Deane & Maiden) Maiden
Kirramyces eucalypti
Phaeothyriolum microthyrioides
Eucalyptus obliqua L'Hér.
Aulographina eucalypti
Blastacervulus eucalypti
Coniothyrium ovatum
Pachysacca samuelii
Thyrinula eucalypti
Vermisporium obtusum
Vermisporium orbiculare
Vermisporium walkeri
Eucalyptus odorata Behr
Pachysacca samuelii
Spilonyces dendriticus
Eucalyptus ovata Labill.
Vermisporium brevicentrum
Eucalyptus pauciflora Spreng.
Ascocoma eucalypti var. *didymospora*
Ascocoma eucalypti var. *eucalypti*
Aulographina eucalypti (Cooke & Massee) von Arx & Muller
Candelabrum brocchiatum
Candelabrum spinulosum
Candelabrum sp.
Conia circularis
Helicodendron triglitziense
Phaeothyriolum microthyrioides
Vermisporium obtusum
Vermisporium walkeri
Eucalyptus polyanthemos Schauer
Fairmaniella leprosa
Macrohilum eucalypti
Phaeothyriolum microthyrioides
Sarcostroma brevilatum
Sonderhenia eucalypticola
Eucalyptus radiata DC
Phaeothriolum microthyrioides
Vermisporium falcatum
Vermisporium obtusum
Eucalyptus regnans F. Muell.
Coniothyrium parvum
Idiocercus australis
Ophiodothella longispora
Pachysacca pusilla
Plectosphaera eucalypti
Vermisporium biseptatum
Vermisporium falcatum
Vermisporium obtusum
Eucalyptus rubida H.Deane & Maiden
Kirramyces eucalypti
Eucalyptus tetrodonta F.Muell.
Phaeothyriolum microthyrioides
Eucalyptus viminalis Labill.
Pachysacca eucalypti
Phaeothyriolum microthyrioides
Plectosphaera eucalypti
Vermisporium biseptatum
Vermisporium brevicentrum

Eucalyptus sp.
Ceuthospora innumera
Clypeophysalospora latitans
Idiocercus australis
Phaeothyriolum microthyrioides
Plectosphaera eucalypti
Rehmiodothis inaequalis
Semifissispora elongata
Stilbospora foliorum
Vermisporium acutatum
Vermisporium orbiculare
Ficus virens Ait.
Phyllachora ficuum
Grevillea aquifolium Lindley
Vizella grevilleae
Grevillea chrysophaea Meissner
Sarcostroma grevilleae
Grevillea laurifolia Sprengel
Sarcostroma grevilleae
Grevillea robusta R.Br.
Sarcostroma grevilleae
Grevillea rosmarinifolia A.Cunn.
Diploceras dilophosporum
Sarcostroma grevilleae
Grevillea steighitziana N.A.Wakef.
Placoasterella baileyi
Sarcostroma grevilleae
Grevillea victoriae F.Muell.
Sarcostroma grevilleae
Hakea crassifolia Meissn.
Vizella banksiae
Hakea dactyloides (Gaertner) Cav.
Sarcostroma hakeae
Hardenbergia violacea (Schneev.) Stearn
Sarcostroma kennedyae
Hypericum perforatum L.
Diploceras hypericinum
Juncus sarophorus L.A.S.Johnson
Laclinum apalum var. *beatonii*
Pseudohelotium asperotrichum
Kennedya prostrata R.Br.
Sarcostroma kennedyae
Leptospermum juniperinum Sm.
Diploceras leptospermi
Leptospermum myrsinoides Schldl.
Harknessia eucalypti Cke
Leptospermum scoparium Forster & G.Forster
Diploceras leptospermi
Leucopogon lanceolatus (Sm.) R.Br.
Sarcostroma leucopogonis
Lomatia ilicifolia R.Br.
Sarcostroma lomatiae
Melaleuca decussata R.Br.
Diploceras dilophosporum (wide spored form)
Melaleuca ericifolia Sm.
Diploceras elegans
Melaleuca lanceolata Otto
Diploceras elegans
Harknessia renispora
Vermisporium cylindrosporum
Melaleuca squarrosa Sm.
Diploceras dilophosporum
Discostromopsis stoneae
Harknessia eucalypti
Harknessia renispora
Janetia interna
Melaleuca wilsonii F.Muell.
Diploceras elegans
Muehlenbeckia sp.
Diploceras muehlenbeckiae
Olearia argophylla (Labill.) Benth.
Rosencheldiella oleariae
Vizella oleariae
Orites lancifolia F.Muell.
Mycosphaerella mycoparasitica
Thallomyces oritidis
Persoonia arborea F.Muell.
Lembosina persooniae
Persoonia elliptica R.Br.
Camarosporula persooniae
Persoonia salicina Pers.
Camarosporula persooniae
Persoonia sp.
Anthracostroma persooniae
Camarosporula persooniae
Platylobium obtusangulum Hook.
Harknessia uromycoides
Sarcostroma kennedyae
Rosa sp.
Sporocadus lichenicola
Vitis sp.
Seimatosporium hysterioides

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Muelleria 9: 255–256 (1996)

Book Review

The Orchids of Victoria. Gary Backhouse & Jeffrey Jeanes. Published by Miegunyah Press, an imprint of Melbourne University Press, Melbourne. 1995, 388 pp. ISBN 0 522 84393 X, Price $AU59.95

If you haven't discovered the diverse, the often bizarre, the frequently captivating, and the exceedingly beautiful array of orchids native to this State, then you must buy *The Orchids of Victoria*. If, on the other hand, you are already in love with these fascinating flowers then buy two copies: one for heavy use in the field, the other to drool over on those rare occasions when there is not an orchid blooming in Victoria. Gary Backhouse and Jeff Jeanes have created a field guide that stands out from all others. It is comprehensive, it is botanically accurate, it is beautifully designed and what's more it works. It is the definitive guide to orchids in Victoria.

Every orchid taxon recorded from Victoria is described, mapped and illustrated (even dubious records from the literature are considered, with explanations given as to why these have been excluded). Each taxon is given a full page, including: a detailed description (using traditional but familiar botanical jargon); a list of similar taxa; flowering time; distribution in terms of floristic regions, the familiar Churchill & de Corona grid system (A to Z) and a map; habitat notes; taxonomic and conservation notes; conservation status (using the Briggs & Leigh codes); and a maginficent colour photograph (labelled with its locality; e.g. Anglesea). Genera are described and discussed in terms of biology and taxonomic relationships, and a key is provided to all species. Preceding the taxonomic heart of the book are chapters on format and photography, orchid terminology and structure, taxonomy and nomenclature, habitats, and conservation and threatened species. A glossary, an index, and bibliographic details of the references cited complete the book. It's well packaged and a delight to use.

Taxonomically, the text is up-to-date. It takes into account the flurry of activity in 1991 and the tidying up that followed, as well as newly described taxa and synonymies unearthed to the end of 1994 (in only one case is a name used prior to its formal publication, i.e. *Genoplesium morrisii* var. *contortum*). The circumscription of genera is little changed from Willis's first volume of *A Handbook to Plants in Victoria* in 1970. Exceptions are the now widely accepted separation of *Genoplesium* from *Prasophyllum*, and the more controversial (but quite logical and responsible) return of *Caladenia menziesii* to its own genus, *Leptoceras*. There are few differences between the taxa accepted in this volume and in the *Flora of Victoria*, and where the texts do diverge, unresolved taxonomic problems still exist. It is a pity, however, that the botanical regions used by Backhouse and Jeanes are not the same as those used in the *Flora of Victoria*.

The alphabetic listing of taxa is not to my taste, particularly in large genera such as *Caladenia* and *Pterostylis* (I'd prefer to have all the *C. patersonii* relatives or the *rufa*-group species of *Pterostylis* bunched together for easier comparison). My main complaint, however, is the dominance of text over illustration. The photographs can certainly take enlargement, which would reveal some of the finer details: e.g. column structure in *Thelymitra aristata* and *T. ixioides*. The photographs are almost without exception of excellent quality, setting a new standard for field guides (in the orchid world, surpassing the generally excellent photographs in Bates & Weber's *Orchids of South Australia* and Hoffman & Brown's *Orchids of South-west Australia*). It is shame to have such beautiful portraits overwhelmed by such large frames. Close-ups of key features would assist in identification, but presumably the book would move from its very reasonable price up into the expensive category.

My final, and more lengthy, quibble would also add considerably to the cost and should be read largely as a self indulgent aside. In accepting all newly described taxa, the authors have (somewhat ironically I guess) taken the more conservative path. A variant named in the scientific literature gains a status far above that of a mere localized growth form. Not only does a Latin name create a sometimes unwarranted credibility, but to get rid of the damn thing you have to explicitly 'sink' the name in a formal synonymy. Easier and safer to accept all names and grumble a little about them in the

taxonomic notes (I know, because I've frequently followed this course in *Flora of Victoria*). But of course the mystique builds with every usage of the name.

Unfortunately, conservation worldwide is species driven (occasionally a subspecies or variety makes the grade, but the point is that a scientific name or explicit scientific recognition is all important). Whether or not the avalanche of new orchid names from Australia in recent years includes 'good' or 'bad' species is not the issue. Recently described species have helped to highlight the diversity of our native orchids and in most cases the species are well characterized by their morphology and biology. The real concern (to me at least) is that these taxonomic constructs (whether viewed as arbitrary slices through a lumpy continuum or some sort of preordained entities) have no place in conservation except to aid communication between consenting adults. To conserve the diversity of orchids in Victoria we must conserve as much of the genetic variation as possible. Local growth variants, colour mutants, and geographically separated populations are all part of this diversity.

So what has all this to do with the book in hand? I support the description and illustration of as much variation as possible. If variants are formally described and named, well and good. What I would like to see, however, is more illustration of variation within species and of variants not lucky enough to carry names. The authors do include sp. aff's in six of the genera, but all of these are expected to be described as species or infraspecies in the near future. To display the real diversity of our flora, named (or pendingly named) taxa should be used as a framework only. This gives Gary Backhouse and Jeff Jeanes a few more volumes to prepare as well as licence to accuse me, as a writer and editor of Floras, of double standards. But that's my prerogative as a reviewer: this book is so good that I want it to be perfect.

It is also my prerogative to unashamedly and unreservedly recommend this book. The authors end their preface with the sentence, 'Our ambition is to have the users of this book rejoicing in the beauty of orchids in the wild for many years to come, and not turning the pages sadly and reflecting on the images of things that once were but are no longer'. What is certain is that users of this book will be rejoicing in their purchase forever.

Tim Entwisle

Corrigendum

Muelleria 8(3): 391–394 (1994)
Notes on *Pultenea* Sm. (Fabaceae) in Victoria
M.G. Corrick

In this paper reference was made to *Pultenaea helophila* on pages 391 and 392. These references should be replaced by the name *Pultenaea sericea*.

CONTENTS

Volume 9 1996